

# **NOTICE**

**All drawings located at the end of the document.**

# GROUND-WATER ASSESSMENT PLAN

U.S. DEPARTMENT OF ENERGY

Rocky Flats Plant  
Golden, Colorado

**September, 1989**



Rockwell International  
Aerospace Operations  
Rocky Flats Plant

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# **ROCKY FLATS PLANT (RFP) GROUND WATER ASSESSMENT PLAN**

## **SECTION 1.0 INTRODUCTION**

The RFP Ground-Water Assessment Plan (GWAP) presents the interim status ground-water monitoring program that is presently being conducted at the RFP. This program reflects the RFP policy to accomplish its mission in an environmentally responsible manner. Protection of human health and the environment are of paramount concern and importance to RFP. The RFP is firmly committed to incorporating federal, state, and local environmental protection goals. Accordingly, it is RFP policy to conduct all operations in compliance with all applicable environmental statutes, regulations and standards. With respect to interim status ground-water monitoring at RFP, procedures and methodologies outlined in 6 CCR 1007-3, Part 265, are followed.

### **1.1 PURPOSE**

The GWAP has been designed to ensure long term quality and consistency of the RFP interim status ground-water monitoring program. The program goal is to fully characterize the RFP ground-water system and the impacts of RCRA regulated units upon that system. The GWAP outlines the methods for determining

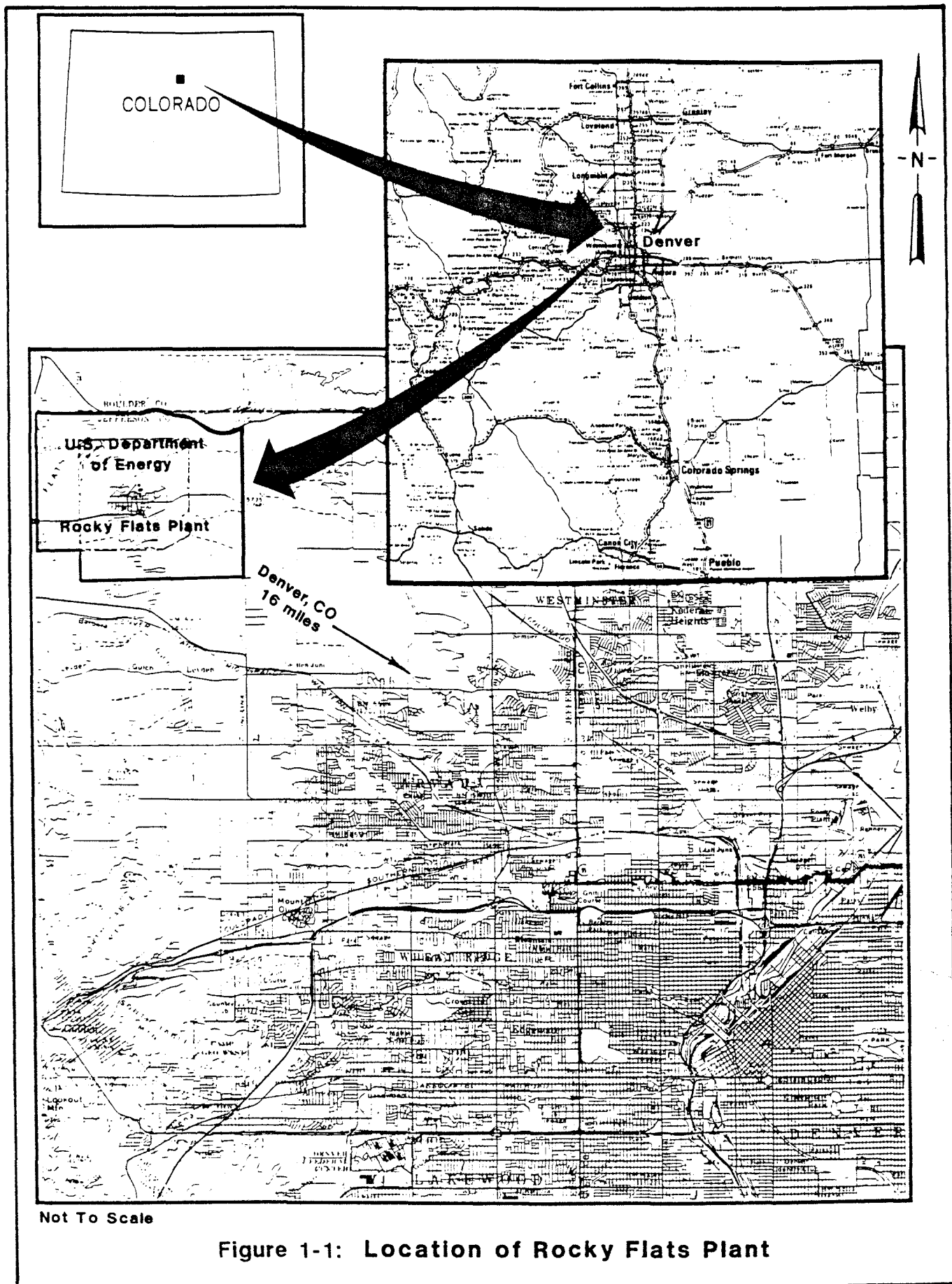
- background ground-water conditions
- whether hazardous waste or hazardous waste constituents have entered the ground water;
- the rate and extent of migration of hazardous waste or hazardous constituents in the ground water; and
- the concentrations of hazardous waste or hazardous waste constituents in the ground water.

The GWAP addresses requests made by the Colorado Department of Health (CDH) at the June 23, 1989 RFP ground water monitoring meeting. The plan presents the objectives of ground water monitoring at RFP, and includes a conceptual discussion on ground water and contaminant plume characterization procedures. Specific ground water issues CDH raised in the June 1989 Compliance Order (No. 89-06-07-01) served to the Department of Energy (DOE) were addressed in the 24 July 1989 response letter to CDH.

## 1.2 RFP DESCRIPTION

RFP is located 16 miles northwest of Denver, in Jefferson County, Colorado (Figure 1-1). The facility encompasses approximately 6550 acres of Federally-owned land. The plant was constructed in 1951, and is a government-owned and contractor-operated (GOCO) facility. Dow Chemical Company began operations in 1952, operating until 1975 under the direction of the Atomic Energy Commission. In 1975 the Energy Research and Development Administration was assigned responsibility for the plant, and Rockwell International was awarded a contract to operate the facility. The Department of Energy succeeded the Energy Research and Development Administration in 1977.

RFP is part of the nationwide nuclear weapons research, development and production complex. The plant produces metal components for nuclear weapons from plutonium, uranium, beryllium, and stainless steel. Other production activities include chemical recovery and purification of recyclable transuranic radionuclides, metal fabrication and assembly, and related quality control functions. The plant conducts research and development programs in metallurgy, machining, non-destructive testing, coatings, remote engineering, chemistry and physics. Parts manufactured at the plant are shipped off-site for final assembly.





Major plant structures, including all production buildings, are located within a 400-acre secure area of the facility. A 6150-acre buffer zone is present along the perimeter of the secure area.

RFP operations generate solid/liquid nonhazardous, hazardous, radioactive, and mixed radioactive waste streams. These wastes are handled and disposed of in a variety of ways. Nonhazardous wastes, such as office trash, are disposed of in an on-site landfill. Hazardous and mixed radioactive wastes are treated on-site, recycled, stored on-site or shipped off-site for disposal. On-site disposal of hazardous and mixed radioactive waste occurred in the past.

### 1.3 RFP SOLID WASTE MANAGEMENT UNITS (SWMUs)

A comprehensive listing of all known and suspected hazardous, radioactive, and mixed radioactive waste sources at RFP has been compiled (Appendix 1). This listing includes descriptions and all known release information for all identified RCRA Solid Waste Management Units (SWMUs). Plates 2-1 and 2-2 show the location of the RFP SWMUs and the RCRA-regulated units.

Each of the waste management units at RFP have been categorized for environmental investigation/cleanup. Waste management units that received hazardous waste after 19 November 1980 require RCRA closure plans. Those land disposal units which received hazardous wastes after 26 July 1982 (regulated units) are also subject to RCRA interim status ground-water monitoring requirements prior to closure, and post-closure care requirements subsequent to closure. The RFP regulated units are described in detail in the RCRA, Post-Closure Care Permit Application (Rockwell, 1988c). Other SWMUs which are known or suspected to contain hazardous wastes have been classified for further investigation into low, medium, and high priority sites based on the threat that is posed to human health and the

environment. These sites are being investigated under the CERCLA/SARA process (preliminary assessments, site investigations, remedial investigations, and feasibility studies).

This GWAP presents an overview of the interim status (6 CCR 1007-3, Part 265 Subpart F) ground-water monitoring program at RFP. Since 1986 work, a number of reports, methodology guidance documents, and workplans have been generated that pertain to groundwater contamination investigations at the RFP. A select group of Rockwell International documents that provide an accurate overview of the RFP environmental studies conducted to date are presented below:

- The Resource Conservation and Recovery Act, Post-Closure Care Permit Application, Volume I, Section E, 1988.
- Remedial Investigation Plan - 903 Pad, Mound and East Trenches Area, Phase II Sampling Plan, 1988.
- Remedial Investigation Plan - 881 Hillside, Phase II Sampling Plan, 1988.
- 1988 Annual RCRA Ground-Water Monitoring Report For Regulated Units at Rocky Flats Plant, Volume 1, 1989.
- Rocky Flats Plant ER Program Standard Operating Procedures, 1989.
- Background Hydrogeochemical Characterization and Monitoring Plan, ER Program, Rocky Flats Plant, 1989.
- Quality Assurance/Quality Control Plan, ER Program, Rocky Flats Plant, 1989.

#### 1.4 GWAP IMPLEMENTATION

This Ground Water Assessment Plan has been implemented. As ground water monitoring strategies change or become more specific, the GWAP will be ammended accordingly.

## SECTION 2.0

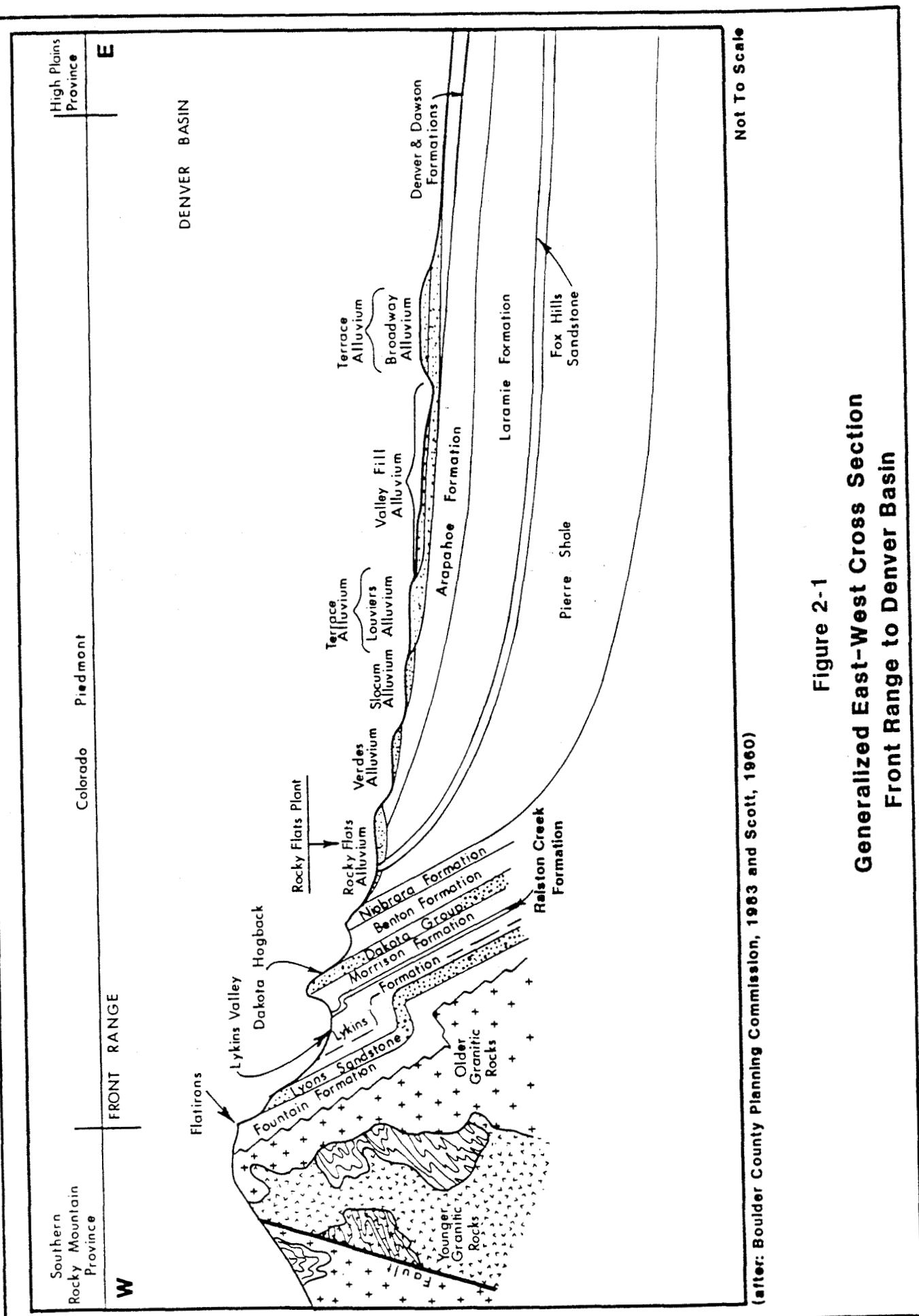
### REGIONAL AND RFP SITE HYDROGEOLOGY

This section presents a discussion of the ground-water flow system at the Rocky Flats Plant, including brief descriptions of regional setting, geology, and site hydrology as defined by recent field investigations.

#### 2.1 REGIONAL GEOLOGIC SETTING

The Rocky Flats Plant is located at an elevation of approximately 6,000 feet above mean sea level. The site is on the western margin of the Colorado Piedmont section of the Great Plains Physiographic Province. The Colorado Piedmont is an area of dissected topography and denudation where Tertiary strata underlying the High Plains have been almost completely removed. The Colorado Piedmont ranges in elevation from 4,000 feet on the east to 7,000 feet on the west. The Colorado Piedmont merges to the east with the High Plains section of the Great Plains Province and is terminated abruptly on the west by the Front Range section of the Southern Rocky Mountain Province (Figure 2.1). The Colorado Piedmont is underlain by north-striking sedimentary beds with dips to the east, away from the Front Range Monocline. Dips are quite steep west of the RFP in the Fox Hills Sandstone and Laramie Formation (on the order of 50 degrees or greater). However, because the axis of the monocline onto the Front Range appears to be inclined to the east, dips become rapidly more gentle, on the order of 7 to 15 degrees beneath the RFP itself (Rockwell International, 1986a). A major bounding fault between the Front Range and the Denver Basin, the Golden Fault, runs north-south several miles west of the RFP at the mountain front.

Several pediments have been eroded across both hard and soft bedrock in the area of the RFP during Quaternary time (Scott, 1965). The Rocky Flats pediment is the most extensive of these, forming a broad flat surface south of Coal Creek. The broad pediments and more narrow terraces are covered by thin alluvial deposits of ancient streams draining eastward into the Great Plains.



(after: Boulder County Planning Commission, 1983 and Scott, 1960)

**Figure 2-1**  
**Generalized East-West Cross Section**  
**Front Range to Denver Basin**

The Rocky Flats Plant is located on a relatively flat surface of Rocky Flats Alluvium. The pediment surface and overlying alluvium (generally 10 to 50 feet thick, although the alluvium is as much as 100 feet thick west of the Plant) have been eroded by Walnut Creek on the north and Woman Creek on the south so that terraces along these streams range in height from 50 to 150 feet. The grade of the gently eastward-sloping dissected Rocky Flats Alluvium surface varies from 0.7 percent at the Plant to approximately 2 percent just east of the Plant.

## 2.2 RFP HYDROGEOLOGY

Geologic units at the Rocky Flats Plant (in descending order) are the surficial units (Rocky Flats Alluvium, Valley Fill Alluvium, and colluvium), the Arapahoe Formation, the Laramie Formation and the Fox Hills Sandstone (Figure 2-2 and 2-3). Ground water occurs in the surficial units and in sandstones in the Arapahoe Formation and the Laramie-Fox Hills aquifer.

### 2.2.1 Rocky Flats Alluvium

The Rocky Flats Alluvium which underlies the plant dominates the hydrology of the area. The Alluvium is a broad planar deposit consisting of a topsoil layer underlain by zero to 75 feet or more of silt, clay, sand, and gravel. The Rocky Flats Alluvium is relatively permeable. Recharge to the alluvium is from precipitation, snowmelt, and water losses from ditches, streams, and ponds that are cut into the alluvium. General water movement in the Rocky Flats Alluvium is from west to east. Discharge from the alluvium occurs at minor seeps and springs in the colluvium that covers the contact of the alluvium and the Arapahoe and Laramie Formations along the edges of the valleys. Ground-water flow is controlled by buried channels in the bedrock. The water table in the Rocky Flats Alluvium rises in response to recharge during the spring and declines during the remainder of the year.

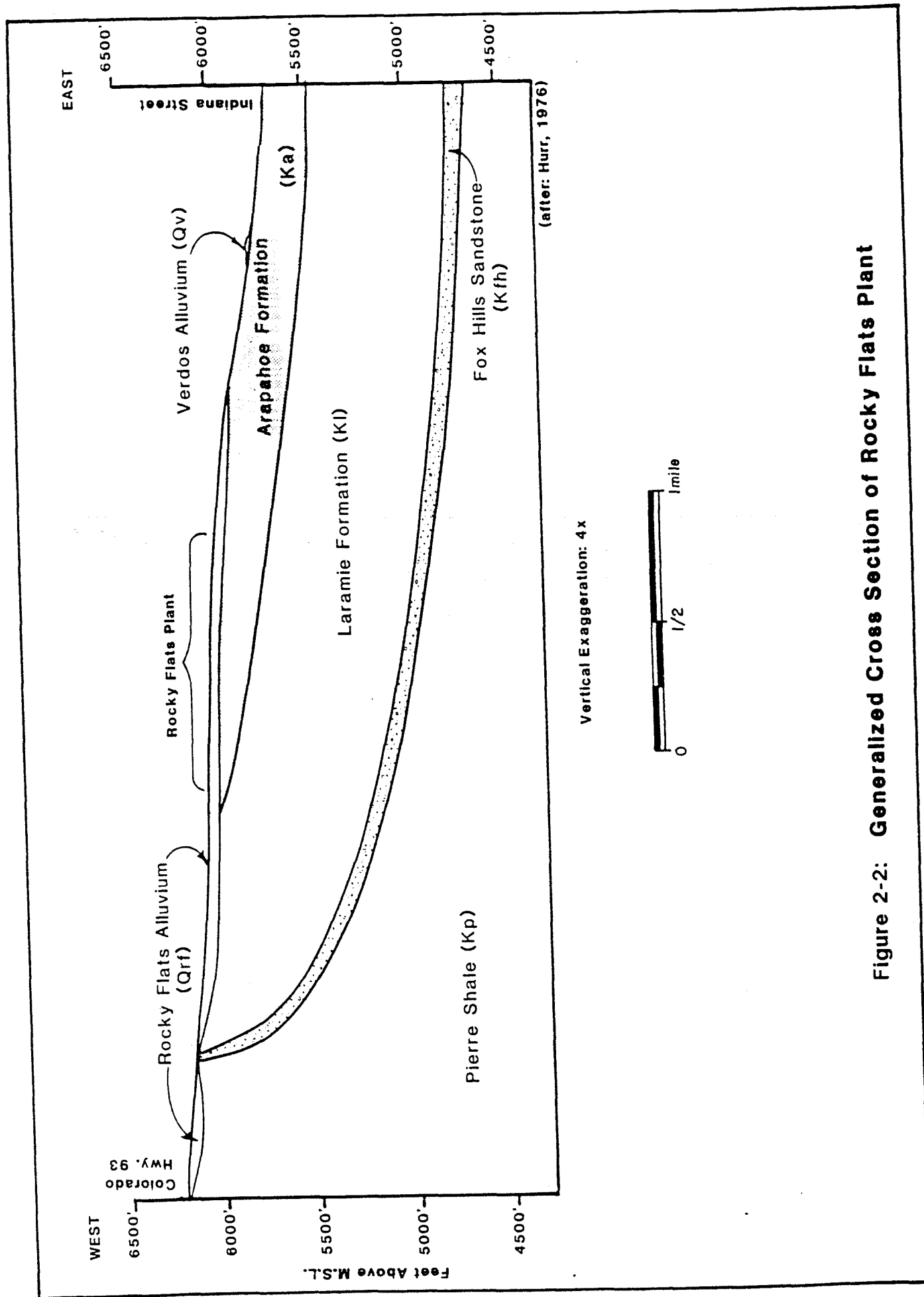
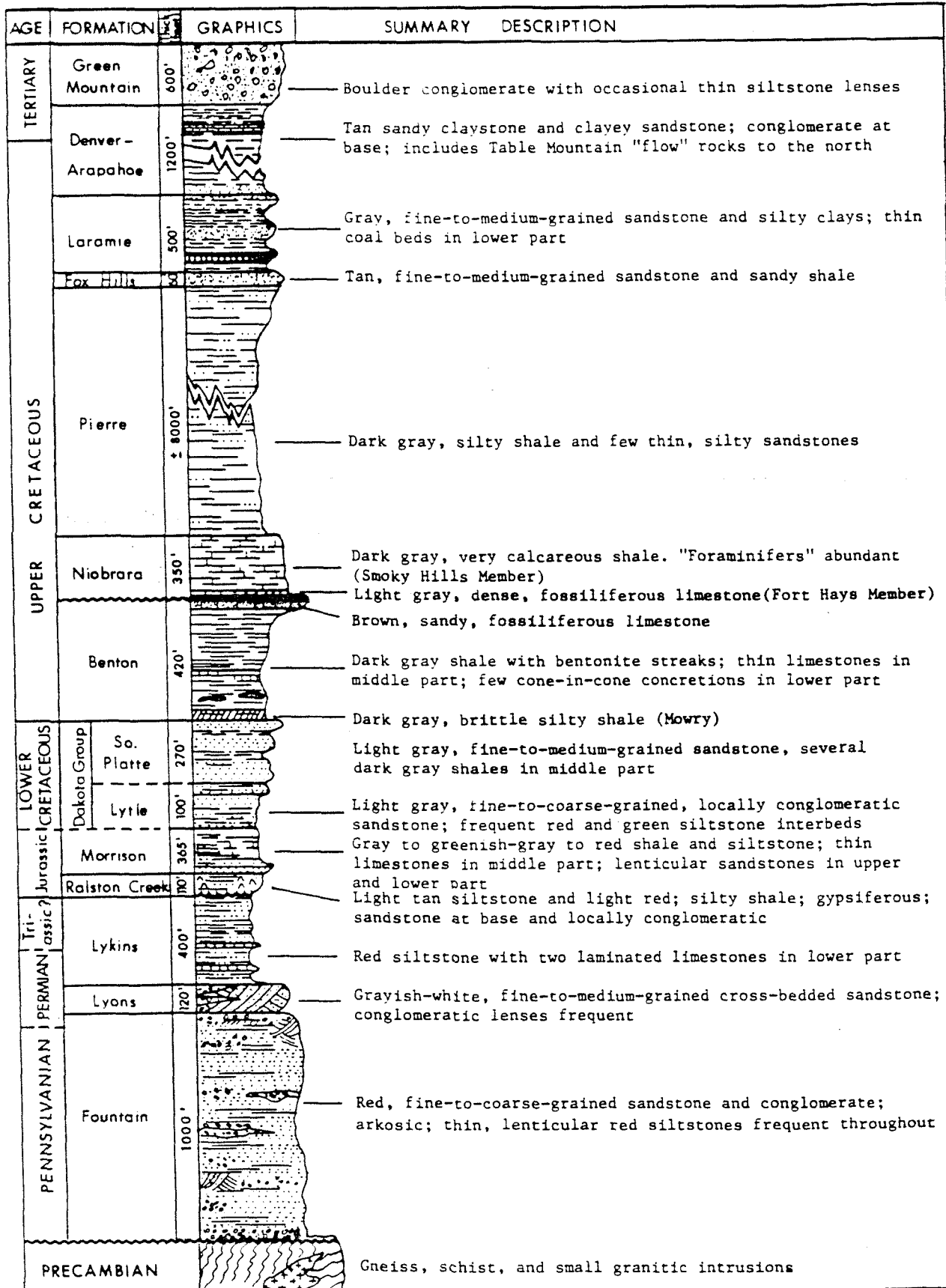


Figure 2-2: Generalized Cross Section of Rocky Flats Plant



**Figure 2-3 Generalized Stratigraphic Section, Golden-Morrison Area**

(after: LeRoy and Welmer, 1971)

The Rocky Flats Alluvium terminates east of the Plant boundary and, therefore, does not supply water to wells located downgradient of Rocky Flats Plant. However, the alluvium is hydraulically connected to surface water, the retention ponds and the underlying bedrock units.

#### 2.2.2 Valley Fill Alluvium and Colluvium

Alluvium in the valleys and stream channels is usually coarser and better sorted than the Rocky Flats Alluvium and, therefore, is more permeable. The alluvium in the stream channels is approximately 10 feet thick. Studies have indicated that ground-water movement in the valley fill alluvium is relatively rapid (Rockwell, 1988a).

Ground water in the colluvium along the bottom of the valleys in the vicinity of the Plant is recharged by precipitation, by percolation from streams during periods of surface water runoff, and by seeps and springs discharging from the Rocky Flats Alluvium. Discharge from the valley fill alluvium is by evapotranspiration and by seepage into other geologic formations and streams. The direction of ground-water flow in these units generally is parallel to the drainages. During periods of high surface water flow, water is lost to bank storage in the alluvium and returns to the stream after the runoff subsides.

The movement of ground water into and out of the valley fill alluvium varies along the length of the valleys. In the upper reaches of the valleys where the valley fill is underlain by the Rocky Flats Alluvium, water moves from the valley fill directly into the Rocky Flats Alluvium. Downstream, where the valley bottom is below the base of the Rocky Flats Alluvium, water moves from the Rocky Flats Alluvium into the valley fill. Where the valleys have been cut into bedrock, water moves from the streams into the valley fill and then recharges the underlying bedrock formations (DOE, 1986a).



### 2.2.3 Arapahoe Formation

The Arapahoe Formation underlies the Rocky Flats Alluvium beneath the Plant area. The Arapahoe consists of claystone with thin lenses of sandstone. It varies in thickness up to 270 feet. The permeable zones of the Arapahoe are lenticular sandstones within the claystone. The lenticular sand bodies are composed of fine-grained sands and silts, and their hydraulic conductivity is low compared to the overlying Rocky Flats Alluvium.

The Arapahoe Formation is recharged by leakage from streams and ground-water movement from overlying surficial deposits. The main recharge areas are under the Rocky Flats Alluvium, although some recharge from the valley fill alluvium occurs along the stream valleys north and south of the plant (DOE, 1980). Recharge is greatest during the spring and early summer when rainfall and stream flow are at a maximum and water levels in the Rocky Flats Alluvium are high.

Ground-water movement in the Arapahoe Formation is generally toward the east. Although there are a few seeps along the sides of the valleys where the Arapahoe Formation outcrops, most of the ground water flows eastward, out of the area. The general direction of movement is toward the South Platte River in the center of the Denver Basin (Robson et al., 1981).

### 2.2.4 Laramie-Fox Hills Formations

The Laramie Formation underlies the Arapahoe and is composed of two units, a thick upper claystone and a lower sandstone. The claystone is greater than 700 feet thick and is of very low hydraulic conductivity; therefore, it is unlikely that plant operations will impact any units below the upper claystone unit of the Laramie Formation.

The lower sandstone units comprise a regionally important aquifer known as the Laramie-Fox Hills Aquifer. The aquifer crops out west of the plant and can be seen in clay pits

excavated through the Rocky Flats Alluvium. The steeply dipping beds of the aquifer quickly flatten to the east. Recharge to the aquifer occurs along the rather limited outcrop area exposed to surface water flow and leakage along the Front Range (Robson et al., 1987).

## 2.3 SURFACE WATER HYDROLOGY

### 2.3.1 Natural Drainages

Three ephemeral streams drain the RFP with flow generally from west to east (Figure 2-4). A topographic divide bisects the RFP. The divide trends east-west and lies slightly south of Central Avenue (the approximate center line of the RFP site). Rock Creek drains the northwestern corner and flows to the northeast in the buffer zone to its off-site confluence with Coal Creek. An interceptor ditch lies between the RFP and Woman Creek. Surface runoff downstream of the interceptor ditch is tributary to Woman Creek, which flows eastward to Standley Lake. North and South Walnut Creeks and an unnamed tributary drain the remainder of the RFP. These three forks of Walnut Creek join in the buffer zone and flow to Great Western Reservoir approximately one mile east of the confluence.

### 2.3.2 Ditches and Diversions

In addition to the natural flows, there are several ditches and surface water diversions in the general vicinity of the RFP (Figure 2-4). The Church, McKay, Kinnear and Reservoir Co. Ditches (diversions of Coal Creek) cross the RFP. Church Ditch delivers water to Upper Church Lake and Great Western Reservoir (City of Broomfield municipal water storage). McKay Ditch also supplies water to Great Western Reservoir. Kinnear Ditch and Reservoir Co. Ditch diverts water from Coal Creek and delivers it to Standley Lake (municipal water storage for the City of Westminster) via Woman Creek. Woman Creek also delivers water to Mower Reservoir. Last Chance Ditch flows south of the RFP and delivers water to Rocky Flats Lake and Twin Lakes. Smart Ditch takes water from Rocky Flats Lake and transports

it out of the area to the east. The South Boulder Diversion Canal runs along the western upgradient edge of the RFP diverting water from South Boulder Creek and delivering it to Ralston Reservoir (City of Denver municipal water storage).

### 2.3.3 Retention Ponds and Plant Discharges

A series of dams, retention ponds, diversion structures, and ditches has been constructed at the RFP to control the rate of release of surface water and limit the potential for release of poor quality water via spills, etc. The ponds are located in the drainages of Walnut and Woman Creeks and are designated the A, B, and C series ponds. Discharges from the downstream pond in each series are in accordance with the RFP's National Pollution Discharge Elimination System (NPDES) permit.

Another retention pond is located on the unnamed northern tributary of Walnut Creek, downstream of the present landfill. Following water quality analyses, the water from the landfill pond is spray irrigated onto an area east of the landfill but upstream of the pond.

The discharges from the ponds are regularly monitored for a broad range of contaminants including those required by the NPDES permit. In addition to NPDES monitoring requirements, all discharges to Walnut and Woman Creeks are monitored for plutonium, americium, uranium, and tritium concentrations.

## SECTION 3.0

### GROUND-WATER MONITORING PLAN

The ground-water monitoring program at RFP has been designed to characterize the geology and hydrology of the site vicinity and to detect the presence and movement of specific contaminants from multiple potential sources within the facility. The objective of the program has always been to monitor ground water quality adjacent to all known potential sources, and if detected, to initiate monitoring to define contaminant plume extent and geometry. Current waste management practices are designed to prevent ground-water contamination, but necessary steps are being taken to effectively address ground-water contamination that has already occurred due to past waste management practices.

#### 3.1 UPPERMOST AQUIFER

At the RFP, ground-water monitoring is conducted to ensure protection of the public health and environment. The ground-water monitoring program complies with the Subpart F requirements of RCRA through measurement of ground-water levels, and collection and analysis of ground water samples from the "uppermost aquifer". Uppermost aquifer is defined and interpreted for the RFP ground-water monitoring program in Section 3.1.2. However, the uppermost water bearing units at the RFP are not aquifers. It is important to make this distinction, even though it does not affect the ground-water monitoring program, because the term "aquifer" suggests potential use as a primary drinking water supply. The limited future use of ground water at the RFP is important with respect to ongoing evaluations of public health and environmental risks posed by the site, and the determination of clean-up standards.

### 3.1.1 Definition of Aquifer

The term aquifer is defined in to CFR Subpart B 191.12(i) as an underground formation, group of formations, or a part of a formation that is capable of yielding a "significant" amount of water to a well or a spring.

"Significant" amount of water to a well or a spring is defined in 40 CFR Subpart B 191.12(m) as an aquifer that:

- 1)
  - is saturated with water having less than 1,000 mg/l total dissolved solids;
  - is within 2,500 feet of the land surface;
  - has a transmissivity greater than 200 gallons per day per foot provided that any formation or part of a formation included within the source for ground water has a hydraulic conductivity greater than 2 gallons per day per square foot ( $5.3 \times 10^{-3}$  cm/sec); and
  - is capable of continuously yielding at least 10,000 gallons per day to a pumped or flowing well for a period of at least a year; or
- 2)
  - provides the primary source of water for a community water system as of the effective date of this Subpart.

Based on this definition, the alluvial and shallow bedrock ground water system at RFP is not an aquifer. In many areas at the RFP site the alluvial materials are not continuously saturated. For the purposes of this section, ground water will be considered to be contained in water-bearing units rather than an aquifer. Hydraulic conductivities for alluvial and bedrock units are less than  $5.3 \times 10^{-3}$  cm/sec and are incapable of yielding significant amounts of water.

### 3.1.2 Interpretation of RCRA Uppermost Aquifer

The uppermost aquifer "means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary". Although the water bearing units at the RFP are not aquifers these definitions are interpreted here for the development of a practical ground-water monitoring system that complies with the intent of the 40 CFR 264 Subpart F ground-water protection regulations and ensures the protection of public health and the environment.

The water-bearing units at the RFP consist of alluvium, colluvium, valley fill alluvium, bedrock sandstones, and weathered and unweathered claystones of the Laramie and Arapahoe Formations. The alluvium, colluvium, and valley fill alluvium best fit the RCRA definition of the uppermost aquifer based on their proximity to the ground surface and higher hydraulic conductivities relative to the other units. Conversely, the unweathered claystone is by no means an aquifer because of its low hydraulic conductivity (generally on the order of  $1 \times 10^{-7}$  to  $1 \times 10^{-8}$  centimeters per second [cm/sec]). This leaves for interpretation whether sandstones and weathered claystones, which are hydraulically interconnected with the alluvial systems, should be a part of this interpretation of "uppermost aquifer". In some locations weathered claystones and sandstones exhibit hydraulic conductivities similar to the unweathered claystone and therefore should not be considered a part of the "uppermost aquifer". However, because hydraulic conductivities for these units vary across the RFP, and in some instances these units subcrop beneath the regulated units (or other SWMUs), they will be considered part of the "uppermost aquifer" where:

- 1) weathered claystones and sandstones crop out beneath a regulated unit (or other SWMU that currently contains or has contained hazardous materials); or
- 2) Saturated sandstones subcrop beneath saturated surficial material that has been contaminated by a regulated unit (or other SWMU), regardless of the location with respect to the regulated unit (or SWMU).

The above interpretation of the uppermost aquifer provides the basis for detecting releases at the point of compliance, and plume characterization in the GWAP.

### 3.2 POINT OF COMPLIANCE

The point of compliance is a term specific to the RCRA regulations pertaining to ground-water monitoring at RCRA-regulated units. Unlike the uppermost aquifer, the definition provided at 40 CFR 264.95(a, b(2)) is straightforward requiring little if any interpretation:

- the compliance point is a vertical surface located at the hydraulically downgradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated units
- if the facility contains more than one regulated unit, the waste management area is described by an imaginary line circumscribing the several regulated units.

At the RFP, RCRA-regulated units are sufficiently far apart that ground-water monitoring at a compliance point encircling all the units would not provide for immediate detection of releases from units hydraulically upgradient of others. Therefore each regulated unit has its own compliance point.

### 3.3 GROUND-WATER MONITORING WELL NETWORK DESIGN

Plate 2-1 shows the locations of over 280 ground-water monitoring wells that comprise the RFP ground-water monitoring well network. These wells have been constructed and located based on several factors. These factors include

- site geology
- site hydrology
- presumed or actual source location, and
- expected plume configuration.

Geophysical methods and soil gas surveys are being used to characterize the local hydrology and to evaluate the need for additional wells to supplement the existing network. As site characterization studies, sampling, analytical and water level data are interpreted over time, the need for additional wells is also evaluated. Additional well requirements are evaluated on a regular basis in the Annual RCRA Ground-Water Monitoring Report.

### 3.3.1 GROUND-WATER FLOW ASSESSMENT PROCEDURES

Ground water flow assessment requires the identification of the uppermost water-bearing unit/aquifer, characterizing the hydraulic properties of the saturated materials, and mapping directions of ground water flow.

The uppermost water-bearing unit/aquifer at RFP consists of the Rocky Flats Alluvium, valley fill alluvium, colluvium, certain subcropping bedrock sandstones, and certain areas of weathered bedrock as discussed in Section 3.1. The lateral extent of the units is relatively well known through surface geological mapping. Characterizing the vertical extent of these units is a continuing process. All boreholes and monitoring wells are lithologically logged during construction. Surface and downhole geophysical surveys are being used to provide additional data. These data enable cross sections and bedrock contour maps to be developed, which provide a picture of subsurface hydrogeological conditions beneath the plant.

Approximately 280 ground-water monitoring wells have been installed at RFP. Monthly water level measurements are taken at the majority of these wells. Because of the dynamic unconfined shallow ground water system at RFP, crews are dispatched to complete water level measurements over a two to four day period. Data from these efforts are used to construct potentiometric maps. Potentiometric maps are used to describe and predict ground water flow directions. When compared with what is known about the subsurface hydrogeological conditions, saturated and unsaturated portions of the flow system can be identified. This information is used to evaluate the need for additional monitoring wells. Potentiometric maps are developed for various months to evaluate the variation in ground water flow



directions and hydrologic conditions over time. Only water level data from wells with documented construction methods are used to develop potentiometric surface maps.

Hydraulic properties of the water bearing units are investigated through the use of single well response tests. These hydraulic tests are used to estimate transmissivity and hydraulic conductivity. Based on hydraulic tests, the range in hydraulic conductivities in the various water bearing units at RFP is being established. Estimates of ground water velocities are calculated based upon the calculated hydraulic conductivities and the rate of change in the potentiometric surface.

### 3.3.2 Plume Definition Methodology

The potential rate of contaminant migration is determined by the ground water velocity as discussed in Section 3.3.1. The methodology described in this section has been developed to determine the horizontal distance of downgradient plume migration with an efficient use of resources. The plume definition methodology is based on anticipated future remedial alternatives and the direction and rate of contaminated ground-water flow. Future ground-water remedial alternatives will consider ground-water withdrawal and treatment. The horizontal area that can be effectively remediated per withdrawal well can help establish the data quality objectives (well spacing) for plume definition.

#### 3.3.2.1 Determination of Maximum Downgradient Extent

Ground water velocities in the uppermost water-bearing units at RFP can be used to estimate the maximum potential extent of contamination using a conservative estimate for the date the ground water became contaminated at the source (or at the subcrop downgradient of the source for a sandstone). A well is installed at this location within the geologic unit under consideration. If the well is "clean", another well is placed at half the original distance. If this well is "clean", the process is repeated; however, the ultimate well spacing need not exceed a 300 feet center well density along the flow line. The selection of 300 feet is based on

projected remedial methodology needs. The assumption is made that a ground-water recovery well network on 300 foot centers could effectively capture all contaminated ground water.

### 3.3.2.2 Determination of the Lateral Plume Extent

The zone of influence of future ground-water collection devices in the uppermost water-bearing units at RFP (*saturated thickness on the order of 10 to 20 feet*) is considered to be no less than 300 feet. This area of influence estimate is based upon field conditions at the Present Landfill and the 881 Hillside Area. Calculations at the Present Landfill indicate that a withdrawal well near the base of a saturated thickness of approximately 10 to 15 feet (hydraulic conductivity of approximately  $1 \times 10^{-5}$  cm/sec), has a zone of influence of no less than 300 feet. Calculations at the 881 Hillside Area indicate that a French drain near the base of a saturated thickness of four feet (hydraulic conductivity of approximately  $1 \times 10^{-4}$  cm/sec) will collect ground-water flow from no less than 300 feet away.

The previous estimates indicate that collection wells could be placed up to 600 feet apart perpendicular to the flow path and still effectively collect all contaminated ground-water flow. Although there are uncertainties in the calculations (e.g., variability in the thickness of the saturated materials, as well as the hydraulic conductivity and porosity of the materials), 600 feet is a reasonable well spacing for determining the lateral extent of contamination. Monitoring wells should be installed, sampled and analyzed starting at the plume centerline and moving sidegradient until the plume is defined within 300 feet.

The above approach need only be used at locations where relatively little characterization data is presently available. This approach is meant to offer a plume delineation procedure for future investigations. However, this approach may also provide a useful guide for identification and validation of additional well requirements at more intensively monitored sites.

### 3.4 PROCEDURES FOR ASSESSMENT OF GROUND WATER QUALITY

Following completion of each new monitoring well at RFP, each is developed to remove fine grained materials that collected in the screened portion of the well as a result of the drilling process. The development process facilitates the entry of water into the monitoring well, and provides for sampling of water free from suspended solids.

Once developed all monitoring wells at RFP undergo quarterly sampling. Upon completion of two years of quarterly sampling with validated analytical results, the feasibility of reducing the sampling frequency and/or the suite of analytes will be assessed. This determination is made on a well by well basis. Future reductions in either sampling or analyses for particular wells will be identified in the Annual RCRA Ground-Water Monitoring Report for Regulated Units. This approach allows for gradual refinement of the ground-water monitoring program in keeping with the program goals as ground-water quality at the RFP is better defined.

#### 3.4.1 Well Construction Methods

The RFP monitoring wells are constructed in a manner to enable measurement of water levels, collection of representative ground-water samples, and conduct of hydraulic tests. The techniques used for constructing a monitoring well have been designed to ensure that the materials and techniques used in construction do not alter the chemical quality of the water being sampled. There are three types of wells at RFP: alluvial/colluvial, shallow bedrock (subcropping sandstone or weathered claystone), and deep bedrock (unweathered sandstone). The construction procedures for these three types of RFP monitoring wells are described in detail in the Background Hydrogeochemical Characterization and Monitoring Plan, Environmental Restoration Program, Rocky Flats Plant (Rockwell, 1989(a)). Typical well construction diagrams are shown in Appendix 2.

#### 3.4.2 Water Level Measurements and Purging Protocol

Prior to sampling monitoring wells at RFP, water level measurements are taken, and purge volumes are calculated and evaluated. These procedures are described in the Rocky Flats Plant Environmental Restoration Program Standard Operating Procedures (SOPs) (Rockwell, 1989 (b)).

#### 3.4.3 RFP Sampling Protocol

Sampling protocol has been developed for RFP to ensure collection of data of known quality for the ground-water monitoring program. Careful documentation of field equipment use and sample handling/preservation protocols is conducted. These protocols are described in detail in the SOPs (Rockwell, 1989 (b)). Field ground-water quality parameters (temperature, pH and specific conductance) are measured with each sampling round.

#### 3.4.4 RFP Analytical Parameters and Procedures

The present list of parameters have been analyzed quarterly since the fourth quarter of 1987. These analytical parameters are presented in Table 3-1.

The analytical methods for all parameters included in the RFP ground-water assessment program are provided in the Rocky Flats Plant Environmental Restoration Program Quality Assurance/Quality Control Plan (QA/QC Plan)(Rockwell, 1989 (c)). This document also presents analytical detection limits, sample container and volume requirements, preservation techniques and sample holding times.

#### 3.4.5 RFP Ground-Water Quality Data Validation

Data is reviewed and validated by the ER Program staff. Results of data review and validation activities are documented in data validation reports. U.S. EPA data validation

functional guidelines are used for validating organic and inorganic (metals) data. Validation methods for radiochemistry and major ions data have not been published by the EPA; however, data and documentation requirements for particular work plans have been published by ER Program QA staff. Data validation methods are derived from these requirements. Details of the data validation process are described in the RFP-QA/QC Plan (Rockwell International, 1989c).

#### 3.4.6 RFP Ground-Water Quality Data Management

The goal of data management at RFP is to provide an organized and structured framework within which all technical data pertaining to this program can be stored, accessed, utilized and tracked. Specific objectives are to provide an organized, accurate, systematic and verifiable method to:

- track all field samples from initial collection, through laboratory analysis, to final disposition.
- track all of the various field data generated during sample collection.
- record all field data using a computerized data management system.
- record and track the results of all laboratory analyses performed on the samples.
- allow all recorded data to be manipulated for data analysis and report preparation.
- track laboratory performance.
- track compliance with the Technical Data Management Plan (Rockwell International, 1989d).

TABLE 3-1

1989 GROUND-WATER SAMPLING PARAMETERS

FIELD PARAMETERS

Specific Conductance

pH

Temperature

METALS (dissolved)

Target Analyte List

Aluminum

Antimony

Arsenic

Barium

Beryllium

Cadmium

Calcium

Chromium

Cobalt

Copper

Iron

Lead

Magnesium

Manganese

Mercury

Nickel

Potassium

Selenium

Silver

Sodium

Thallium

Tin

Vanadium

Zinc

Cesium

Lithium

Molybdenum

Strontium

ANIONS

Carbonate

Bicarbonate

Chloride

Sulfate

Nitrate

Cyanide

Total Dissolved Solids

TABLE 3-1  
(continued)

1989 GROUND-WATER SAMPLING PARAMETERS

ORGANICS

Target Compound List- Volatiles

Chloromethane  
Bromomethane  
Vinyl Chloride  
Chloroethane  
Methylene Chloride  
Acetone  
Carbon Disulfide  
1,1-Dichloroethene  
1,1-Dichloroethane  
1,2-Dichloroethene (total)  
Chloroform  
1,2-Dichloroethane  
2-Butanone  
1,1,1-Trichloroethane  
Carbon Tetrachloride  
Vinyl Acetate  
Bromodichloromethane  
1,1,2,2-Tetrachloroethane  
1,2-Dichloropropane  
trans-1,3-Dichloropropene  
Trichloroethene  
Dibromochloromethane  
1,1,2-Trichloroethane  
Benzene  
cis-1,3-Dichloropropene  
Bromoform  
2-Hexanone  
4-Methyl-2-pentanone  
Tetrachloroethene  
Toluene  
Chlorobenzene  
Ethyl Benzene  
Styrene  
Total Xylenes

RADIONUCLIDES

Gross Alpha  
Gross Beta  
Uranium 233+234, 235, and 238  
Americium 241  
Plutonium 239+240  
Strontium 89 and 90  
Cesium 137  
Radium 226, 228  
Tritium

### 3.5 RFP Ground-Water Quality Data Interpretation

The results of the RFP interim status ground-water monitoring program are presented in the Annual RCRA Ground-Water Monitoring Report for Regulated Units. This section presents the interpretive tools to be used to assess the information gathered from the ground water monitoring program.

#### 3.5.1 Background Ground-Water Quality

Representative background analytical data are necessary for interpreting ground-water monitoring analytical results. Background data assists in the evaluation of environmental degradation by determining naturally-occurring spatial and temporal variability of constituents. Background data can then be statistically compared with data from downgradient sites to determine the likelihood that a particular concentration of chemicals represents a release from the site. Background data can also be used to evaluate whether upgradient chemical concentrations at a site represent a release from other SWMUs.

A background characterization program is underway that has the following goals (Rockwell International, 1989b):

- establish a baseline monitoring program to characterize background soils, surface water, and ground-water chemistry;
- use information from the baseline program to identify changes in site water chemistry due to Plant operations;
- provide data to enable statistical comparisons to be made that can identify central tendencies and water quality variability over time at both upgradient and downgradient locations.
- to evaluate whether releases at particular sources have occurred by comparing background water quality, downgradient water quality, and applicable or relevant and appropriate requirements (ARARs).

The details of the ongoing background characterization program are described in the Background Hydrogeochemical Characterization and Monitoring Plan (Rockwell, 1989a).



### 3.5.2 Statistical Determination of Contaminant Release

To detect contaminant releases to ground water from sites/units, well-specific data are compared to the range of background concentrations (tolerance intervals), and to previous well-specific data. Contamination may be identified by the presence of hazardous constituents or the increase in concentration of naturally-occurring constituents. Determination that a constituent concentration in ground water represents contamination is based on 1) comparison of new data to the background tolerance interval; 2) trend testing, and/or 3) use of control charts. These methods are used to:

- compare site downgradient/upgradient data to background concentrations of constituents at different stations; and
- compare a station's current concentrations of constituents to past concentrations, so that the station serves as its own control.

For water, neither comparison alone is sufficient in all monitoring situations, so it is necessary that both comparisons be made. The Background Hydrogeochemical Characterization and Monitoring Plan presents a step-by-step procedure for using tolerance intervals, a test for trends, and control charts to achieve monitoring objectives, i.e., to determine hydrogeochemical conditions and variability, and to detect hydrogeochemical changes and impacts from sites/units at RFP.

#### Interstation Comparisons

Downgradient and background stations will be compared on a quarterly basis. The results of this comparison will be presented in the Annual RCRA Ground-Water Monitoring Report for Regulated Units. Each downgradient concentration will be compared to the range (where range is defined as a statistical tolerance interval) of concentrations in background stations. A tolerance interval defines, with a specified probability, a range of values that contain a discrete percentage of the population. Downgradient stations whose concentrations fall outside the tolerance interval may indicate an impact to ground water has occurred.

In order to obtain reliable results, both a high level of confidence (95%) and a high percentage of the population within the interval (95%) are chosen as statistical parameters. The number of sampling stations in the background area determines the width of the tolerance interval, i.e., the more background stations, the narrower the interval and the more likely it will be that contamination in downgradient locations will be detected. Nine background stations have been established in the Background Hydrogeochemical Characterization and Monitoring Plan (Rockwell, 1989a) in order to obtain a 95 percent tolerance interval (95% of population within the one-sided interval) with a tolerance factor of three at the 95% confidence level, i.e., the upper limit of the tolerance interval is the mean plus three standard deviations of the sample population. Tolerance limits can be used to detect distinct differences between upgradient and downgradient conditions for a single monitoring event. Control charts and trend tests can be used to detect gradual changes over longer time periods.

#### Intrastation Comparisons

Comparing a station with its own past behavior (intrastation comparison) is an effective way to detect changes over time. Only after a data history is available to establish the chemical pattern of a station can the observed concentrations be compared. A pattern that takes the form of a trend in concentrations over time is evidence of changing conditions which may indicate an impact.

This ground-water assessment plan proposes the use of graphs and statistical control charts for intrastation comparisons. A control chart is a graphical procedure for determining whether the current concentration is above or below control limits established for the station.

The control limits are based on past variability in concentrations at the station and define typical behavior for the station when trends are not present. The graph itself can often indicate a trend, depending on its magnitude and linearity. The presence of seasonal data can also be indicated, and accounted for, in the analysis.

### 3.6 DRY WELL ASSESSMENT AND INTERPRETATION

RFP contains many wells that are dry during certain seasons or throughout the year. In some cases, wells are dry because the entire alluvial section is dry due to lack of upgradient recharge. In order to ascertain that the entire alluvial section is dry, it is necessary to distinguish between wells where the screened interval is set to bedrock and those wells where the screened interval lies above the bedrock surface. In the first case a dry well represents a dry alluvial section. In the second case the water table may be present in the alluvium below the screened interval. The alluvial section, in this case, could not be considered dry without more information.

Dry wells are more common in certain areas, such as the Solar Evaporation Ponds and 881 Hillside. Dry wells are generally found in areas where bedrock is structurally high, or near buildings where ground water has been diverted. These wells should be retained to provide an indication of ground-water conditions which may change over time. If a well remains dry for two years, and is screened to bedrock, it is considered for abandonment. If a well is always or periodically dry, and is not screened to bedrock, replacement is considered.

### 3.7 RATIONALE FOR AN IDENTIFICATION OF WELLS FOR ABANDONMENT/REPLACEMENT

There are several reasons for which a well may be proposed for abandonment, including:

- indication of well damage;
- lack of documented construction details;
- faulty construction;
- conflict with plans for remediation;
- conflict with building construction at RFP;

- location of well in area subject to flooding, and
- dry wells.

Visual inspections, analytical and field measurements during sampling activities can identify potential problem wells. Problem wells may be identified through observations indicating casing or pad damage, animal burrowing, high pH, and turbid water. These observations will be evaluated once a year and will be described in the Annual RCRA Ground-Water Monitoring Report.

Wells for which construction details are not available may be completed over multiple water-bearing zones. In this situation water level measurements represent composite, rather than discrete zones and should not be used for potentiometric mapping. Also the potential exists for cross-contamination of hydraulically distinct zones if the well lies downgradient of a SWMU. Probing the well with a downhole camera may provide information on completion that may enable the well to be salvaged. Otherwise, abandonment may be the best option.

Faulty construction of a well increases the likelihood for cross-contamination, but may be difficult to document. Construction problems include leaky seals that allow water to flow in the well annulus. Evidence of these situations include high (irregular) pH readings or turbid ground water.

A well may be recommended for abandonment if it is located in an area scheduled for excavation either for remedial purposes or for building construction. Wells that are subject to flooding conditions become ineffectual for water level measurements or sampling purposes. These wells are in hydraulic communication with surface water features and represent erroneous ground-water conditions.

Wells may be added to the monitoring network to replace wells that have been abandoned for the reasons stated above. Replacement for abandoned wells will be considered

on a case by case basis. There are 29 wells at RFP that have been identified as potential candidates for abandonment. Table 3-2 describes all wells at RFP.

Standard procedures for monitoring well abandonment utilized in the water well and/or petroleum industries will be used at RFP. All closures will be performed in compliance with the requirements of the State of Colorado (State Board of Examiners of Water Well Construction and Pump Installation Contractors, 1987). Each well closure will be assessed independently, taking into account the borehole diameter, depth, hole deviation, formation properties, and casing condition. If artesian conditions exist, the sealing operation will be designed to confine the water and prevent loss of artesian pressure or transfer of groundwater between aquifers.

### 3.8 REPORTING AND RECORDKEEPING REQUIREMENTS

Analytical and field measurement records generated in the RFP ground-water assessment program will be maintained throughout interim status monitoring periods, under the supervision of the RCRA/CERCLA Group. All documents including this program plan will be stored in a central library at the group's facilities. In addition, all data will be stored as hardcopy in the group's files. Data will also be stored in a single database management system on the plant's central computer. Data will be stored for the life of the facility and through the post-closure care period.

The RFP ground-water monitoring program will comply with RCRA which requires that 1) a record be kept of the analyses and evaluations specified in the plan, which satisfies the requirements of § 265.94(d)(3), throughout the active life of the facility, and, for disposal facilities, throughout the post-closure care period as well; and 2) a report be submitted annually, until final closure of the facility, to the Regional Administrator containing the results of the ground-water quality assessment program which includes, but is not limited to, the calculated (or measured) rate of migration of hazardous waste or hazardous waste

TABLE 3-2  
DETAILS OF EXISTING MONITOR WELLS  
AT ROCKY FLATS PLANT

WELL NUMBER	ROCKY FLATS E. COORDINATE (FT.)	ROCKY FLATS N. COORDINATE (FT.)	STATE E. COORDINATE (FT.)	STATE N. COORDINATE (FT.)	TOTAL DEPTH (FT.)	CASING DIAMETER (INCHES)	CASING MATERIAL (PVC, STEEL)	COMMENTS
0171	23205.50	35823.90	0.0000	0.0000	30.05	6	S	1,N
0174	23069.00	36643.80	0.0000	0.0000	24.96	6	P	1,N
0181	27080.50	40306.70	0.0000	0.0000	0.00	6	P	1
0186	30852.20	31888.76	2093956.1730	744890.8209	10.20	2	S	
0187	20540.59	35145.60	2083652.9398	748127.4287	12.08	2	S	E
0189A	15183.13	31600.11	2078308.5787	744565.1830	51.35	4	P	B
0189P	15183.24	31599.94	2078308.6909	744565.0139	38.26	1	P	2,8
0260	21898.40	38204.60	0.0000	0.0000	0.00	6	S	1,S
0271	22831.33	35528.12	0.0000	0.0000	29.23	6	S	1,N
0281	26730.30	40692.10	0.0000	0.0000	0.00	6	P	1
0286	30806.15	35751.34	2093909.9580	748753.4096	9.01	2	S	
0287	20819.75	34725.76	2083933.4097	747708.6194	9.32	2	S	E
0289	16017.21	31676.84	2079142.1870	744644.6479	51.25	4	P	
0374	23884.50	36944.90	0.0000	0.0000	25.04	6	P	1,N
0382	17447.20	37038.10	0.0000	0.0000	0.00	6	P	1
0386	30674.20	37498.83	2093772.9260	750500.8882	23.67	2	S	
0387	20847.58	34723.33	2083961.2436	747706.2876	108.00	2	S	E
0389	15266.77	30794.80	2078394.8565	743760.3577	50.30	4	P	B
0460	22404.90	37593.40	0.0000	0.0000	0.00	6	S	1,S
0481	18949.50	34586.50	0.0000	0.0000	0.00	6	P	1
0486	30774.18	40437.06	2093878.0130	753439.1026	14.92	2	S	
0487	21774.11	34957.41	2084886.7577	747943.3600	19.70	2	S	E
0489	16077.58	30852.36	2079205.2666	743820.5973	55.70	4	P	B
0582	15017.10	36486.00	0.0000	0.0000	0.00	6	P	1,M
0586	26699.71	40694.77	2089803.3040	753696.6539	9.76	2	S	
0587	21736.48	35095.27	2084848.6844	748081.0586	51.50	2	S	E
0589	20445.99	41857.55	2083536.2088	754837.3134	33.31	4	P	B

1	Potential candidate for abandonment	L	Present Landfill Alternate Monitoring System
2	1 inch diameter well unsuitable for sampling	N	903 Pad, Mound, East Trenches Monitoring System
B	RFP Background Water-Quality Monitoring System	S	Solar Evaporation Ponds Assessment Monitoring System
E	881 Hillaide Monitoring System	W	West Spray Field Alternate Monitoring System

TABLE 3-2  
DETAILS OF EXISTING MONITOR WELLS  
AT ROCKY FLATS PLANT

WELL NUMBER	ROCKY FLATS E. COORDINATE (FT)	ROCKY FLATS N. COORDINATE (FT.)	STATE E. COORDINATE (FT.)	STATE N. COORDINATE (FT.)	TOTAL DEPTH (FT.)	CASING DIAMETER (INCHES)	CASING MATERIAL (PVC, STEEL)	COMMENTS
0681	19381.30	37878.50	0.0000	0.0000	0.00	6	P	1
0682	15020.60	36436.70	0.0000	0.0000	0.00	6	P	1, W
0686	23577.53	40588.07	2086681.1250	753589.8207	8.88	2	S	E
0687	22021.30	35016.02	2085133.6830	748002.7765	7.06	2	S	B
0689	21069.70	42256.66	2084158.4353	755238.3808	32.80	4	P	1, N
0774	25071.90	36427.90	0.0000	0.0000	50.15	6	P	1
0781	19414.70	37878.70	0.0000	0.0000	0.00	6	P	1, W
0782	12985.70	35835.90	0.0000	0.0000	0.00	6	P	L
0786	20880.70	39845.61	2083977.4451	752827.3366	5.74	2	S	B
0789	21921.46	42781.02	2085008.2449	755765.4125	30.47	4	P	1, W
0881	16553.30	36993.60	0.0000	0.0000	0.00	6	P	L
0886	20904.37	39835.33	2084001.1452	752817.1407	63.80	2	S	E
0887	21180.72	34774.29	2084294.2980	747758.1749	89.34	2	S	B
0889	22617.22	43199.87	2085702.4430	756186.4526	24.70	4	P	1, E
0974	21671.20	35042.80	0.0000	0.0000	0.00	6	P	1, W
0981	16615.10	36991.20	0.0000	0.0000	0.00	6	P	L
0986	19373.26	39213.81	2082472.4814	752190.7211	135.35	2	S	N
0987	22239.33	36080.84	2085348.1453	749068.0299	32.40	2	S	B
0989	24169.13	42275.09	2087256.9934	755267.0405	9.60	4	P	1, E
1074	21592.60	35002.30	0.0000	0.0000	0.00	6	P	1, W
1081	12975.30	35885.70	0.0000	0.0000	0.00	6	P	L
1086	19391.62	39191.66	2082490.9168	752168.6413	23.78	2	S	N
1087	22180.04	35959.99	2085289.2754	748947.0158	12.00	2	S	B
1089	23771.64	44655.14	2086851.7585	757645.1486	36.50	4	P	S
1186	26930.96	40321.19	2090034.5660	753323.0847	10.25	2	S	N, E
1187	22989.24	35419.39	2086100.0436	748409.2366	20.50	2	S	B
1189	20500.44	44616.73	2083581.5337	757595.9555	26.11	4	P	

1	Potential candidate for abandonment	L	Present Landfill Alternate Monitoring System
2	1 inch diameter well unsuitable for sampling	N	903 Pad, Mound, East Trenches Monitoring System
B	RFP Background Water-Quality Monitoring System	S	Solar Evaporation Ponds Assessment Monitoring System
E	881 Hillside Monitoring System	W	West Spray Field Alternate Monitoring System

TABLE 3-2  
DETAILS OF EXISTING MONITOR WELLS  
AT ROCKY FLATS PLANT

WELL NUMBER	ROCKY FLATS E. COORDINATE (FT.)	ROCKY FLATS N. COORDINATE (FT.)	STATE E. COORDINATE (FT.)	STATE N. COORDINATE (FT.)	TOTAL DEPTH (FT.)	CASING DIAMETER (INCHES)	CASING MATERIAL (PVC, STEEL)	COMMENTS
1286	24790.54	39343.29	2087894.1920	752345.0900	11.30	2	S	N,E
1287	22956.17	35590.92	2086066.4205	748580.6049	10.25	2	S	B
1289	22254.49	44092.75	2085336.8529	757077.9027	11.64	4	P	S
1386	22950.96	38866.98	2086054.6310	751868.7040	9.50	2	S	B
1389	23567.14	44338.93	2086648.3480	757328.3495	10.50	4	P	1
1474	16969.00	34142.20	0.0000	0.0000	0.00	6	P	S
1486	22737.62	38866.36	2085841.2950	751868.0736	55.36	2	S	N
1487	23504.68	35236.67	2086615.9564	748228.2626	24.30	2	S	B
1489	22207.35	34321.96	2085321.9781	747309.5078	24.45	4	P	S
1586	22711.56	38862.88	2085815.2310	751864.5874	14.69	2	S	N
1587	23139.88	36020.14	2086248.6590	749010.3218	22.53	2	S	B
1589	18514.33	32873.07	2081634.7119	745848.8073	22.65	4	P	1,M
1674	25169.30	34723.90	0.0000	0.0000	0.00	6	P	S
1686	22159.67	38759.90	2085263.3550	751761.5911	45.06	2	S	N
1687	23140.49	36139.59	2086248.8779	749129.7454	125.24	2	S	B
1689	20373.64	33804.66	2083490.4540	746786.2956	15.00	4	P	S
1786	22141.73	38752.33	2085245.4080	751754.0125	13.98	2	S	N
1787	23200.70	36424.92	2086308.1281	749415.1940	25.75	2	S	B
17898R	18357.65	33366.04	2081476.4480	746339.1279	24.60	4	P	S
1886	22729.83	30532.38	2085833.5150	751534.0933	7.50	2	S	N
1887	23231.24	36413.74	2086338.6941	749404.1222	133.70	2	S	B
1889	16414.83	40124.54	2079511.8167	753091.4539	14.22	4	P	S
1986	20194.72	37941.84	2083298.4340	750943.4422	12.25	2	S	N
1987	23064.85	36633.42	2086171.6264	749623.1990	11.89	2	S	B
1989	17161.65	40864.32	2080256.0041	753833.5009	12.61	4	P	S
2086	21253.70	38110.34	2084357.8350	751112.2940	10.55	2	S	N
2087	23048.42	36644.48	2086155.1645	749634.1973	116.36	2	S	

1	Potential candidate for abandonment	L	Present Landfill Alternate Monitoring System
2	1 inch diameter well unsuitable for sampling	N	903 Pad, Mound, East Trenches Monitoring System
B	RFP Background Water-Quality Monitoring System	S	Solar Evaporation Ponds Assessment Monitoring System
E	881 Hillside Monitoring System	W	West Spray Field Alternate Monitoring System



TABLE 3-2  
DETAILS OF EXISTING MONITOR WELLS  
AT ROCKY FLATS PLANT

WELL NUMBER	ROCKY FLATS E. COORDINATE (FT.)	ROCKY FLATS N. COORDINATE (FT.)	STATE E. COORDINATE (FT.)	STATE N. COORDINATE (FT.)	TOTAL DEPTH (FT.)	CASING DIAMETER (INCHES)	CASING MATERIAL (PVC, STEEL)	COMMENTS
2089	20812.14	44414.51	2083893.8232	757394.8213	14.65	4	P	B
2186	21142.87	37947.59	2082502.7900	750911.3910	67.25	2	S	
2187	22693.84	36980.21	2085799.5648	749968.6664	10.56	2	S	N,S
2189	22633.57	45126.22	2085712.4261	758112.3564	13.40	4	P	B
2274	24002.40	36542.50	0.0000	0.0000	41.05	3	P	1,H
2286	21307.73	37734.93	2084411.7500	750737.0124	11.20	2	S	S
2287	22715.72	36934.99	2085821.5930	749923.5377	88.70	2	S	N,S
2289	15145.64	34264.35	2078262.3036	747228.6049	5.85	4	P	
2386	21154.44	37354.96	2084258.6160	750356.9109	117.00	2	S	S
2387	22802.78	36415.15	2085910.3415	749404.1201	37.85	2	S	N
2389	23104.08	31715.79	2086227.0823	744706.9744	10.17	4	P	B
2486	21172.85	37354.83	2084277.0230	750356.7783	7.45	2	S	S
2487	23640.05	36759.05	2086746.2613	749750.6926	13.85	2	S	N
2489	26406.34	32824.94	2089524.8098	745826.7435	12.10	4	P	B
2586	21726.54	37426.35	2084830.7080	750428.3257	82.00	2	S	S
2587	23641.38	36727.08	2086747.6965	749718.7298	43.70	2	S	N
2589	28146.31	32347.94	2091265.9007	745355.6090	9.65	4	P	B
2686	21737.23	37425.81	2084841.4010	750427.7921	11.00	2	S	S
2687	24381.98	36261.48	2087489.6385	749255.6958	13.70	2	S	N
2689	30864.52	29260.92	2093993.5910	742278.3685	8.90	4	P	B
2786	22134.90	37794.14	2085239.0500	750796.1398	133.00	2	S	S
2787	24944.62	36442.01	2088051.5380	749438.0421	43.25	2	S	N
2789BR	20466.34	41868.42	2083556.5119	754848.2491	46.47	4	F	B
2886	22137.05	37816.25	2085241.2020	750818.2480	8.60	2	S	S
2887	24983.42	36442.31	2088090.3222	749438.4716	197.70	2	S	N
2889BR	21087.88	42258.71	2084176.6034	755240.4851	46.00	4	P	B
2986	22584.10	37610.26	2085688.2660	750612.2896	8.77	2	S	S

1	Potential candidate for abandonment	L	Present Landfill Alternate Monitoring System
2	1 inch diameter well unsuitable for sampling	N	903 Pad, Mound, East Trenches Monitoring System
B	RFP Background Water-Quality Monitoring System	S	Solar Evaporation Ponds Assessment Monitoring System
E	881 Hillside Monitoring System	W	West Spray Field Alternate Monitoring System

TABLE 3-2  
DETAILS OF EXISTING MONITOR WELLS  
AT ROCKY FLATS PLANT

WELL NUMBER	ROCKY FLATS E. COORDINATE (FT.)	ROCKY FLATS N. COORDINATE (FT.)	STATE E. COORDINATE (FT.)	STATE N. COORDINATE (FT.)	TOTAL DEPTH (FT.)	CASING DIAMETER (INCHES)	CASING MATERIAL (PVC, STEEL)	COMMENTS
2089	20812.14	44414.51	2083893.8232	757394.8213	14.65	4	P	B
2186	21142.87	37947.59	2082502.7900	750911.3910	67.25	2	S	
2187	22693.84	36980.21	2085799.5648	749968.6664	10.56	2	S	N, S
2189	22633.57	45126.22	2085712.4261	758112.3564	13.40	4	P	B
2274	24002.40	36542.50	0.0000	0.0000	41.05	3	P	1, N
2286	21307.73	37734.93	2084411.7500	750737.0124	11.20	2	S	S
2287	22715.72	36934.99	2085821.5930	749923.5377	88.70	2	S	N, S
2289	15145.64	34264.35	2078262.3036	747228.6049	5.85	4	P	
2386	21154.44	37354.96	2084258.6160	750356.9109	117.00	2	S	S
2387	22802.78	36415.15	2085910.3415	749404.1201	37.85	2	S	N
2389	23104.08	31715.79	2086227.0823	744706.9744	10.17	4	P	B
2486	21172.85	37354.83	2084277.0230	750356.7783	7.45	2	S	S
2487	23640.05	36759.05	2086746.2613	749750.6926	13.85	2	S	N
2489	26406.34	32824.94	2089524.8098	745826.7435	12.10	4	P	B
2586	21726.54	37426.35	2084830.7080	750428.3257	82.00	2	S	S
2587	23641.38	36727.08	2086747.6965	749718.7298	43.70	2	S	N
2589	28146.31	32347.94	2091265.9007	745355.6090	9.65	4	P	B
2686	21737.23	37425.81	2084841.4010	750427.7921	11.00	2	S	S
2687	24381.98	36261.48	2087489.6395	749255.6958	13.70	2	S	N
2689	30864.52	29260.92	2093993.5910	742278.3685	8.90	4	P	B
2786	22134.90	37794.14	2085239.0500	750796.1398	133.00	2	S	S
2787	24944.62	36442.01	2088051.5380	749438.0421	43.25	2	S	N
27898R	20466.34	41868.42	2083556.5119	754848.2491	46.47	4	P	B
2886	22137.05	37816.25	2085241.2020	750818.2480	8.60	2	S	S
2887	24983.42	36442.31	2088090.3222	749438.4716	197.70	2	S	N
28898R	21087.88	42258.71	2084176.6034	755240.4851	46.00	4	P	B
2986	22584.10	37610.26	2085688.2660	750612.2896	8.77	2	S	S

1 Potential candidate for abandonment  
2 1 inch diameter well unsuitable for sampling  
B RFP Background Water-Quality Monitoring System  
E 881 Hillside Monitoring System  
L Present Landfill Alternate Monitoring System  
N 903 Pad, Mound, East Trenches Monitoring System  
S Solar Evaporation Ponds Assessment Monitoring System  
W West Spray Field Alternate Monitoring System

TABLE 3-2  
DETAILS OF EXISTING MONITOR WELLS  
AT ROCKY FLATS PLANT

WELL NUMBER	ROCKY FLATS E. COORDINATE (FT.)	ROCKY FLATS N. COORDINATE (FT.)	STATE E. COORDINATE (FT.)	STATE N. COORDINATE (FT.)	TOTAL DEPTH (FT.)	CASING DIAMETER (INCHES)	CASING MATERIAL (PVC, STEEL)	COMMENTS
2987	24249.82	35094.87	2087361.3703	748088.9555	20.50	2	S	N
2989BR	21964.89	42806.76	2085051.5736	755791.2886	41.25	4	P	B
3086	21819.60	38092.45	2084923.7410	751094.4326	14.93	2	S	S
3087	24312.43	35095.15	2087423.9554	748089.4398	94.35	2	S	N
3089BR	22658.39	43221.96	2085743.5243	756208.6744	40.94	4	P	B
3186	21661.75	38066.23	2084765.8910	751068.2028	17.32	2	S	N
3187	25201.86	36502.97	2088308.5132	749499.8322	129.64	2	S	1, B
3189BR	23487.29	43755.65	2086570.4441	756744.9537	37.30	4	P	S
3286	21640.65	38065.73	2084744.7910	751067.7058	125.50	2	S	S
3287	25256.21	36513.70	2088362.8092	749510.7405	46.80	2	S	N
3289BR	21944.19	42792.37	2085030.9263	753776.8324	140.84	2	P	B
3386	21896.47	36960.93	2085000.2370	749962.6590	7.34	2	S	N, S
3387	24815.13	36859.07	2087920.7058	749856.5591	20.25	2	S	N
3389BR	22635.78	43211.47	2085720.9612	756198.1067	113.90	2	P	B
3486	23088.39	37171.41	2086192.1520	750173.1389	56.25	2	S	N, S
3487	24825.73	36840.38	2087931.3614	749835.9078	104.49	2	S	N
3489BR	23469.07	43740.80	2086552.2861	756730.0554	132.70	2	P	B
3586	23114.38	37176.97	2086218.1420	750178.7010	11.60	2	S	N, S
3587	24162.59	36981.20	2087267.9351	749974.5030	9.60	2	S	N
3589BR	24227.96	41904.59	2087317.0381	754896.8288	115.23	2	P	B
3686	23715.31	37395.41	2086819.1070	750397.1536	6.50	2	S	N, S
3687	24189.80	36985.79	2087295.1168	749979.1830	63.59	2	S	N
3689BR	25382.07	42344.56	2088469.3930	755340.4960	97.62	2	P	B
3786	25758.47	38561.44	2088862.4820	751563.0018	8.55	2	S	S
3787	22119.81	37507.14	2085223.9506	750493.5645	9.00	2	S	S
3789BR	23092.28	31688.14	2086215.3718	744679.3015	90.95	2	P	B
3789P	23098.54	31699.33	2086221.5936	744690.5072	10.00	1	P	2, B

1	Potential candidate for abandonment	L	Present Landfill Alternate Monitoring System
2	1 inch diameter well unsuitable for sampling	N	903 Pad, Mound, East Trenches Monitoring System
B	RFP Background Water-Quality Monitoring System	S	Solar Evaporation Ponds Assessment Monitoring System
E	881 Hillside Monitoring System	W	West Spray Field Alternate Monitoring System

TABLE 3-2  
DETAILS OF EXISTING MONITOR WELLS  
AT ROCKY FLATS PLANT

WELL NUMBER	ROCKY FLATS E. COORDINATE (FT.)	ROCKY FLATS N. COORDINATE (FT.)	STATE E. COORDINATE (FT.)	STATE N. COORDINATE (FT.)	TOTAL DEPTH (FT.)	CASING DIAMETER (INCHES)	CASING MATERIAL (PVC, STEEL)	COMMENTS
3886	27177.53	39822.72	2090281.3730	752825.8544	8.50	2	S	S
3887	22020.53	37370.70	2085125.1508	750356.8364	9.50	2	S	S
3889BR	23567.29	41797.90	2086656.8840	754787.9885	112.22	2	P	B
3986	27591.82	38288.72	2090695.5130	751290.6447	31.50	2	S	S
3987	22166.32	38094.04	2085268.5066	751080.4636	117.39	2	S	S
3989BR	22184.13	34321.35	2085298.7662	747308.8221	39.14	4	P	S
4086	25398.09	36612.84	2088501.8570	749614.6648	111.50	2	S	N
4087	21727.76	40158.03	2084823.2504	753142.4673	6.70	2	S	L
4089BR	26451.93	32815.29	2089570.4247	745817.2440	25.90	4	P	B
4186	25437.08	36611.43	2088540.8520	749613.2570	44.70	2	S	N
4187	21725.75	40133.61	2084821.3199	753118.0508	94.03	2	S	L
4189BR	26481.33	32799.24	2089599.8742	745801.2931	86.25	2	P	N
4286	24007.88	36565.80	2087111.6510	749567.5710	29.70	2	S	L
4287	22430.99	40355.10	2085525.6453	753341.8104	6.60	2	S	L
4289BR	19330.97	33804.20	2082448.0614	746782.3900	24.45	4	P	B
4386	22761.70	36415.05	2085865.4760	749416.7604	16.75	2	S	N
4387	21675.56	35043.82	2084787.9460	748029.4259	12.50	2	S	E
4389BR	19347.76	33819.62	2082464.7930	746797.8628	48.00	2	P	S
4486	19130.51	36252.35	2082236.2780	749254.0826	26.25	2	S	S
4487	22323.69	35317.96	2085435.0051	748305.6314	3.70	2	S	N,E
4489BR	23109.08	31726.76	2086232.0415	744717.9612	26.30	4	P	B
4586	16363.17	37348.30	2079469.3332	750315.7647	48.20	2	S	W
4587	22340.05	35325.47	2085451.3360	748313.1987	101.30	2	S	N,E
4589BR	15235.37	32239.76	2078358.6905	745204.8392	50.05	4	P	S
4686	15178.84	37890.63	2078283.5295	750854.0477	160.79	2	S	W
4689	23775.15	44664.12	2086855.2290	757654.1441	18.00	4	P	B
4786	15184.12	37860.86	2078288.9026	750824.3042	94.49	2	S	W

1 Potential candidate for abandonment  
2 1 inch diameter well unsuitable for sampling  
B RFP Background Water-Quality Monitoring System  
E 881 Hillside Monitoring System

L Present Landfill Alternate Monitoring System  
N 903 Pad, Mound, East Trenches Monitoring System  
S Solar Evaporation Ponds Assessment Monitoring System  
W West Spray Field Alternate Monitoring System

TABLE 3-2  
DETAILS OF EXISTING MONITOR WELLS  
AT ROCKY FLATS PLANT

WELL NUMBER	ROCKY FLATS E. COORDINATE (FT)	ROCKY FLATS N. COORDINATE (FT.)	STATE E. COORDINATE (FT.)	STATE N. COORDINATE (FT.)	TOTAL DEPTH (FT.)	CASING DIAMETER (INCHES)	CASING MATERIAL (PVC, STEEL)	COMMENTS
4787	21789.41	34792.68	2084902.5941	747778.7224	7.50	2	S	E
4789	16062.22	30851.28	2079189.9129	743819.4561	23.75	4	P	B
4886	15175.95	36025.21	2078286.7940	748989.1054	207.07	2	S	W
4887	21578.31	34844.28	2084691.3770	747829.6141	10.30	2	S	E
4889	16092.40	30853.20	2079220.0762	743821.4683	53.72	4	P	B
4986	15176.73	36000.49	2078287.6576	748964.3973	67.60	2	S	W
4987	21891.49	35004.54	2085003.9476	747990.8687	5.00	2	S	E
4989R	18357.49	33357.04	2081476.3079	746332.1311	46.75	4	P	B
5086	14183.95	34822.03	2077299.0283	747782.9679	96.15	2	S	W
5087	22222.15	35133.80	2085334.0958	748121.1820	13.70	2	S	N,E
5089	18357.88	33374.00	2081476.6474	746349.0917	8.50	4	P	B
5186	13023.57	35618.33	2076136.3239	748575.2232	79.06	2	S	W
5187	20738.10	35120.00	2083850.4816	748102.4865	14.08	2	S	E
5189R	0.00	0.00	0.0000	0.0000	0.00	4	P	
5286	13019.60	35649.91	2076132.2445	748606.7872	125.80	2	S	W
5287	20956.54	35161.94	2084066.7281	748145.1309	20.50	2	S	E
5386	15261.49	32996.62	2078365.4220	745998.0085	7.80	2	S	
5387	20799.60	35002.12	2083912.3575	747984.8454	9.30	2	S	E
5486	15216.09	32292.85	2078320.0490	745294.2401	85.25	2	S	B
5487	20919.36	35001.45	2084032.0807	747984.5675	4.68	2	S	E
5586	15217.16	32259.45	2078321.1160	745260.8365	36.39	2	S	B
5587	21805.12	34633.09	2084918.8244	747619.2290	7.50	2	S	E
5686	17104.16	34071.93	2080208.0350	747073.3934	9.60	2	S	W
5687	21319.10	37654.23	2084422.9610	750637.9781	9.92	2	S	S
5786	18456.94	34584.14	2081571.6829	747559.2362	6.75	2	S	
5886	20319.54	34102.78	2083423.4220	747104.3846	3.50	2	S	L
5887	19431.75	39257.05	2082530.8143	752234.1479	22.50	2	S	

1	Potential candidate for abandonment	L	Present Landfill Alternate Monitoring System
2	1 inch diameter well unsuitable for sampling	N	903 Pad, Mound, East Trenches Monitoring System
B	RFP Background Water-Quality Monitoring System	S	Solar Evaporation Ponds Assessment Monitoring System
E	881 Hillside Monitoring System	W	West Spray Field Alternate Monitoring System

TABLE 3-2  
DETAILS OF EXISTING MONITOR WELLS  
AT ROCKY FLATS PLANT

WELL NUMBER	ROCKY FLATS E. COORDINATE (FT.)	ROCKY FLATS N. COORDINATE (FT.)	STATE E. COORDINATE (FT.)	STATE N. COORDINATE (FT.)	TOTAL DEPTH (FT.)	CASING DIAMETER (INCHES)	CASING MATERIAL (PVC, STEEL)	COMMENTS
5986	21153.12	34770.41	2084256.9680	747772.0500	28.00	2	S	1,E
5986R	21146.63	34769.30	2087260.0565	747753.2293	28.60	2	S	E
5987	19463.99	39336.25	2082562.7831	752313.4319	21.20	2	S	1,L
6086	21168.04	34786.41	2084271.8950	747788.0554	89.34	2	S	
6087	19938.52	39951.63	2083035.1629	752930.2157	27.70	2	S	L
6186	20608.69	36217.45	2083712.4340	749219.1741	12.25	2	S	E
6187	19974.80	39881.26	2083071.6615	752859.9820	28.50	2	S	L
6286	22613.19	35154.34	2085717.0180	748156.0499	35.19	2	S	N,E
6287	19999.70	39821.22	2083096.7557	752800.0483	26.80	2	S	L
6386	22641.50	35156.04	2085745.3360	748157.7520	15.50	2	S	N,E
6387	20040.50	39738.07	2083137.8203	752717.0549	25.50	2	S	L
6486	22497.26	34683.82	2085601.1100	747685.5186	9.00	2	S	N,E
6487	20162.23	39347.01	2083260.8028	752328.4970	23.80	2	S	L
6586	24389.54	34886.65	2087493.3790	747888.4362	8.00	2	S	N
6587	20200.22	39250.14	2083299.1087	752229.7725	24.20	2	S	L
6686	28151.55	33638.66	2091255.4530	746640.6086	6.50	2	S	
6687	20226.01	39170.26	2083325.1571	752150.0056	18.20	2	S	L
6786	27253.77	35706.56	2090362.5100	748710.4048	14.75	2	S	
6787	20678.79	40182.78	2083774.4728	753163.7495	16.80	2	S	L
6886	20466.13	34172.96	2083570.0100	747174.5774	3.50	2	S	
6887	20680.82	40163.59	2083776.5639	753144.5694	16.00	2	S	
6986	21168.07	34786.10	2084271.8950	747788.0554	14.00	2	S	E
7086	18889.15	34515.44	2081993.0080	747516.9900	7.90	2	S	
7087	21098.79	39588.09	2084196.3239	752570.6048	16.50	2	S	L
7187	20991.74	40339.90	2084086.8247	753321.8654	13.85	2	S	L
7287	20855.24	39459.12	2083953.2719	752440.8680	7.00	2	S	L
LF0189	19481.76	39332.69	2082580.5651	752309.9358	24.47	4	P	L

1	Potential candidate for abandonment	L	Present Landfill Alternate Monitoring System
2	1 inch diameter well unsuitable for sampling	N	903 Pad, Mound, East Trenches Monitoring System
B	RFP Background Water-Quality Monitoring System	S	Solar Evaporation Ponds Assessment Monitoring System
E	881 Hillside Monitoring System	W	West Spray Field Alternate Monitoring System

TABLE 3-2  
DETAILS OF EXISTING MONITOR WELLS  
AT ROCKY FLATS PLANT

WELL NUMBER	ROCKY FLATS E. COORDINATE (FT)	ROCKY FLATS N. COORDINATE (FT.)	STATE E. COORDINATE (FT.)	STATE N. COORDINATE (FT.)	STATE TOTAL DEPTH (FT.)	CASING DIAMETER (INCHES)	CASING MATERIAL (PVC, STEEL)	COMMENTS
LF0289R	20202.58	39352.08	2083301.1349	752331.6987	36.61	4	P	L
LF0389R	20465.42	39272.29	2083564.1629	752252.7932	43.05	4	P	L
LF0489	20828.68	39566.50	2083926.3615	752548.1310	14.74	4	P	L
LF0589R	20865.79	39445.20	2083963.8580	752426.9809	11.35	4	P	L
LF0689R	21023.37	39475.67	2084121.3012	752457.9652	36.24	4	P	L
LF0889R	21263.69	39605.08	2084361.1292	752588.1377	19.41	4	P	L
LF0989R	21064.34	39836.16	2084161.0679	752818.4917	20.52	4	P	L
LF1089R	21684.46	39838.69	2084781.0174	752823.0740	18.20	4	P	L
LF1189R	21739.67	40160.69	2084835.1519	753145.1662	22.50	4	P	L
LF1289R	21741.54	40118.58	2084837.1608	753103.0804	54.00	4	P	L
LF1389R	21741.74	40107.09	2084837.3996	753091.5903	77.76	4	P	L
LF1489R	21264.93	40284.53	2084360.1298	753267.4134	15.89	4	P	L
P21389	23573.81	37546.69	2086677.4351	750537.9074	8.25	4	P	O
P21489	23005.19	37476.24	2086109.2037	750465.5934	22.03	4	P	O
P21489A	22997.66	37478.56	2086101.6663	750467.8951	7.20	4	P	O
P23689	18139.90	37363.59	2081245.5536	750336.9191	50.10	4	P	
P23789	18625.88	37421.38	2081731.2112	750396.2994	37.60	4	P	
P24589	18554.67	36983.76	2081661.4722	749958.5590	39.30	4	P	
P24689	18150.68	36957.22	2081257.6731	749930.6945	42.01	4	P	
P25189	19911.10	36552.86	2083018.9618	749532.2506	21.31	4	P	
P25389	17607.76	36153.12	2080717.5469	749125.0033	44.50	4	P	
P25589	17608.29	35632.69	2080719.7925	748604.7115	35.39	4	P	
P25889	17518.14	35341.30	2080630.6320	748313.0993	31.40	4	P	
SEP0189R	21362.90	37211.07	2084468.2117	750195.0750	16.22	4	P	S
SEP0289	21376.11	37212.89	2084481.4116	750196.9387	8.23	4	P	S
SEP0389R	21738.72	37410.11	2084843.2789	750395.3056	25.10	4	P	S
SEP0489	22213.85	37411.33	2085318.2830	750398.0917	14.36	4	P	S

1 Potential candidate for abandonment  
2 1 inch diameter well unsuitable for sampling  
B RFP Background Water-Quality Monitoring System  
E 881 Hillside Monitoring System

Present Landfill Alternate Monitoring System  
905 Pad, Mound, East Trenches Monitoring System  
Solar Evaporation Ponds Assessment Monitoring System  
West Spray Field Alternate Monitoring System

TABLE 3-2  
DETAILS OF EXISTING MONITOR WELLS  
AT ROCKY FLATS PLANT

WELL NUMBER	ROCKY FLATS E. COORDINATE (FT.)	ROCKY FLATS N. COORDINATE (FT.)	STATE E. COORDINATE (FT.)	STATE N. COORDINATE (FT.)	TOTAL DEPTH (FT.)	CASING DIAMETER (INCHES)	CASING MATERIAL (PVC, STEEL)	COMMENTS
SEP0589R	22239.07	37405.58	2085343.5153	750392.4264	28.63	4	P	S
SEP0689	22239.84	0.00	0.0000	0.0000	8.95	4	P	S
SEP0789R	22226.17	37683.92	2085329.7025	750670.6537	21.73	4	P	S
SEP0889	22774.48	38154.24	2085876.3167	751142.6631	14.16	4	P	S
SEP0989R	22783.27	38149.60	2085885.1182	751138.0462	27.58	4	P	S
SEP1089R	23188.76	38748.93	2086288.5239	751738.5561	16.16	4	P	S
SEP1189	22484.18	38699.83	2085584.2911	751687.1526	9.03	4	P	S
SEP1289R	22535.71	38495.29	2085635.8216	751682.7802	30.49	4	P	S
SEP1389	22377.09	38816.83	2085476.8443	751803.7634	5.07	4	P	S
SEP1489R	22149.83	38741.72	2085249.8873	751727.9190	23.07	4	P	S
SEP1589	21350.22	38771.39	2084450.3881	751754.9488	12.29	4	P	S
SEP1689R	22146.42	38099.65	2085248.5938	751086.0131	99.16	4	P	S
SEP1789R	21736.17	38058.90	2084838.5849	751043.9176	0.00	4	P	S
SEP1889R	21806.82	37580.29	2084910.7997	750565.6668	27.21	4	P	S
SEP1989R	21206.43	37778.78	2084309.9151	750762.1193	36.08	4	P	S
SEP2089	21036.04	37880.23	2084139.2271	750862.9837	13.40	4	P	S
SEP2189R	21026.45	37881.34	2084129.6435	750864.0572	30.05	4	P	S
SEP2289R	21531.26	38007.03	2084633.9052	750991.3874	36.25	4	P	S
SEP2389R	22183.90	38084.38	2085286.1226	751070.8669	19.77	4	P	S
SEP2489R	22409.68	37546.03	2085513.6161	750533.4077	27.93	4	P	S
SEP2589	22377.11	37591.43	2085480.9001	750578.6819	13.75	4	P	S
SEP2689R	21882.16	38208.53	2084984.0492	751193.9933	19.63	4	P	S
SEP2889	21547.81	38580.65	2084648.5530	751564.9068	9.58	4	P	S
SEP2989R	21538.57	38579.31	2084639.3225	751563.5389	22.93	4	P	S
SEP3089R	21307.33	37767.66	2084410.8220	750751.3364	37.13	4	P	S
SEP3189R	22119.26	37577.96	2085223.1660	750564.3631	22.27	4	P	S
SEP3289R	22016.16	38710.01	2085116.3609	751695.7831	24.35	4	P	S

1	Potential candidate for abandonment	L	Present Landfill Alternate Monitoring System
2	1 inch diameter well unsuitable for sampling	N	903 Pad, Mound, East Trenches Monitoring System
B	RFP Background Water-Quality Monitoring System	S	Solar Evaporation Ponds Assessment Monitoring System
E	881 Hillside Monitoring System	W	West Spray Field Alternate Monitoring System



TABLE 3-2  
DETAILS OF EXISTING MONITOR WELLS  
AT ROCKY FLATS PLANT

WELL NUMBER	ROCKY FLATS E. COORDINATE (FT.)	ROCKY FLATS N. COORDINATE (FT.)	STATE E. COORDINATE (FT.)	STATE N. COORDINATE (FT.)	TOTAL DEPTH (FT.)	CASING DIAMETER (INCHES)	CASING MATERIAL (PVC, STEEL)	COMMENTS
SEP3389	22413.47	38814.87	2085513.2184	751801.9259	8.67	4	P	S
SF0289	0.00	0.00	0.0000	0.0000	51.33	4	P	W
SF0489	16163.82	36378.45	2079273.2456	749345.5103	65.77	4	P	W
SF0589	15670.14	36829.23	2078778.2010	749794.5450	66.85	4	P	W
SF0689	14471.85	36684.03	2077580.7020	749645.4253	73.82	4	P	W
SF0689A	14464.71	36682.03	2077573.5733	749643.4040	0.00	4	P	W
SF0789	13830.94	35758.28	2076943.0216	748717.8034	69.65	4	P	W
SF0889	14600.74	35765.89	2077712.5879	748727.9516	70.08	4	P	W
WS01	19412.70	39561.20	2082510.7803	752537.8954	2.15	12	S	1,1
WS02	21100.80	39599.90	2084198.2618	752582.4097	14.33	4	P	1

- 1 Potential candidate for abandonment  
2 1 inch diameter well unsuitable for sampling  
B RFP Background Water-Quality Monitoring System  
E 881 Hillside Monitoring System  
L Present Landfill Alternate Monitoring System  
N 903 Pad, Mound, East Trenches Monitoring System  
S Solar Evaporation Ponds Assessment Monitoring System  
W West Spray Field Alternate Monitoring System

constituents in the ground-water during the reporting period. This information is submitted no later than March 1 in the Annual RCRA Ground-Water Monitoring Report for Regulated Units. Contaminant concentration isopleth maps for "indicator" parameters are prepared for this report. These "indicators" are used to depict ground water contamination based on a high elevated concentration, mobility, and/or representativeness of the type of contamination.

## SECTION 4.0

### INTERIM STATUS GROUND-WATER MONITORING REQUIREMENTS

The RFP is a "facility" as defined in the CDH hazardous waste regulations (6 CCR 1007-3 260.10). Owners and operators of a RCRA facility, must have a permit during the active life (including the closure period) of the facility.

According to 6 CCR 1007-3 100.10 and 40 CFR 270.70(a), the owner or operator of an existing facility will have interim status and shall be treated as having been issued a permit if the owner or operator has complied with the requirements of Section 3010(a) and 270.10. During the interim status period, the facility will comply with the interim status standards of 6 CCR and 40 CFR Part 265 (6 CCR 1007-3 100.20(3)(b)(1); 40 CFR 270.71(b)). Interim status ground-water monitoring of each regulated unit at Rocky Flats Plant will continue until the closure of the unit is certified (6 CCR 1007-3 100.20(c); 40 CFR 270.73(a)). The closure plans for the interim status regulated units have been consolidated and submitted to the CDH in the Post-Closure Care Permit Application (October 5, 1988). Once a post-closure care permit is issued to DOE/Rockwell, interim status will terminate and Part 264 Subpart F requirements will then be applicable (during the post closure care period). At that time the Rocky Flats Plant will comply with 6 CCR 1007-3 and 40 CFR Parts 264.90 through 264.100 for ground-water monitoring and response programs.

The Part 265.90 regulations require that a surface impoundment, landfill, or land treatment facility which is used to manage hazardous waste, implement, as part of interim status operation a ground-water monitoring program capable of determining the facility's impact on the uppermost aquifer underlying the facility. Implementation of the ground-water monitoring program includes the installation, operation, and maintenance of a ground-water monitoring system which meets the requirements of 265.91 and 265.92 through 265.94. The ground-water monitoring program must be carried out during the active life of the facility and during the post-closure care period for disposal facilities.

If the owner or operator assumes that ground-water monitoring of indicator parameters in accordance with 265.91 and 265.92 would show statistically significant increases when evaluated under 265.93(b), he may install, operate, and maintain an alternate ground-water monitoring system (265.90(d)). Because actual or assumed releases of hazardous constituents have occurred from the RFP regulated units, a ground-water quality assessment program is required pursuant to 265.90(d) (alternate monitoring for assumed releases) and 265.93(d)(2) (assessment monitoring for actual releases). The requirements for alternate and assessment monitoring are similar as both programs must comply with the regulations at 265.93(d)(2) through 265.93(d)(7). If the owner or operator uses an alternate/assessment ground-water monitoring system, he must:

- Within one year after the effective date of these regulations, submit a specific plan which satisfies the requirements of 265.93(d)(3) (6 CCR 1007-3 and 40 CFR 265.90(d)(1) and 265.93(d)(2)).
- The written plan must be submitted not later than one year after the effective date of the regulations. The plan will include the number, location and depth of wells; sampling and analytical methods for those hazardous wastes or waste constituents at the facility; evaluation procedures including the use of previously gathered ground-water quality information; and a schedule of implementation (6 CCR 1007-3 and 40 CFR 265.90(d)(2), 265.93(d)(3)).
- The ground-water plan must be capable of determining whether hazardous waste or hazardous waste constituents have entered the ground water (6 CCR 1007-3 265.93(a), the rate and extent of migration of the hazardous constituents in the ground water, and the concentrations of the hazardous constituents in ground water. Within fifteen days after the evaluation of the data, a written ground-water quality assessment report including the results of the determinations will be submitted to the Regional Administrator (6 CCR 1007-3 and 40 CFR 265.90(d)(4), 265.90(d)(5) and 265.93(d)(4), 265.93(d)(5)).
- The rate and extent of migration of the hazardous constituents, and the concentrations of the hazardous constituents, as specified in 265.93(d)(4) will be determined on a quarterly basis until final closure of the facility (6 CCR 1007-3 and 40 CFR 265.90(d)(4)).
- Recordkeeping and reporting requirements must comply with (6 CCR 1007-3 and 40 CFR 265.94(b)). The records of the analyses and evaluations specified in the plan must be kept throughout the post-closure care period (6 CCR 1007-3 and 40 CFR 264.94(b)(1)).
- A report must be submitted to the Regional Administrator on an annual basis until final closure, and no later than March 1st of each calendar year. The report will include the results of the ground-water quality assessment program including reports on the quarterly ground-water quality data (6 CCR 1007-3 and 40 CFR 264.94(b)(2)).

## SECTION 5.0

### THE RFP MONITORING WELL NETWORK RATIONALE

At present (September 1, 1989) there are 281 existing monitor wells at the Rocky Flats Plant. These wells were installed in eight different drilling programs over the period 1960 to present. Plate 2-1 shows the location of existing monitoring wells and the approximate locations for the 43 proposed (as of September 1, 1989) 1989 wells. Complete lithology logs and well constructions are available for wells installed in 1986 and 1987 (Rockwell, 1988) and will be available for wells installed in 1989 (Rockwell, 1989a).

Records for pre-1986 wells are much more limited. Geologic logs are available for the 1966 and 1974 wells. Well completion details are available for the 1966 wells. A few of the pre-1986 wells were geophysically logged in early 1985 to expand the subsurface database. Data from the other pre-1986 drilling programs are not available. Based on the available data, most of the pre-1986 wells are apparently completed in both the bedrock and the alluvium.

Tables 5-1, 5-2, 5-3 and 5-4 list the rationale for construction, well diameter, casing materials, and survey coordinates where available, for all existing Rocky Flats Plant background, and RCRA regulated unit monitor wells. In addition, wells are noted for which borehole geophysical logs are available, and monitor wells which are candidates for abandonment are flagged in Tables 5-2, 5-3 and 5-4. As indicated in these table, all pre-1986 wells will be evaluated for abandonment because of the limited amount of data available for those wells.

#### 5.1 WEST SPRAY FIELD ALTERNATE MONITORING SYSTEM

The West Spray Field is located in the western portion of the RFP Buffer Zone. This site was identified as a RCRA regulated unit because liquids contaminated with listed

TABLE 5-1  
BACKGROUND WELLS

Well No.	Zone of Completion	Screen Depth (ft)	Total Depth of Well (ft)	Comments
55-86	Alluvial	3.55-36.39	36.39	Upgradient
54-86	Alluvial	75.43-85.24	85.25	Upgradient
1-89A	Qrf	10.09-49.60	51.35	Sidegradient
1-89P	Qrf	28.58-37.95	38.26	Sidegradient
3-89	Qrf	9.50-49.00	50.30	Sidegradient
4-89	Qrf	9.87-54.45	55.70	Sidegradient
5-89	Qrf	11.86-31.57	33.31	Sidegradient
6-89	Qrf	11.58-31.05	32.80	Sidegradient
7-89	Qrf	9.07-28.50	30.47	Sidegradient
8-89	Qrf	8.60-23.12	22.80	Sidegradient
9-89	Qc	3.48-7.83	9.60	Sidegradient
10-89	Qc	20.36-34.80	36.50	Sidegradient
11-89	Qc	14.73-23.90	26.11	Sidegradient
12-89	Qc	5.53-9.96	11.64	Sidegradient
13-89	Qc	4.38-8.76	10.50	Sidegradient
14-89	Qc	13.16-22.60	24.45	Sidegradient
15-89	Qc	6.55-21.00	22.65	Sidegradient
16-89	Qc	3.85-13.30	13.50	Sidegradient
17-89BR	Kass	13.50-22.90	24.60	Sidegradient
18-89	Qvf	3.00-12.47	14.22	Sidegradient
19-89	Qvf	3.74-10.90	12.61	Sidegradient
20-89	Qvf	3.43-12.90	14.65	Sidegradient
21-89	Qvf	4.53-11.60	13.40	Sidegradient
23-89	Qvf	4.00-8.55	10.17	Sidegradient
24-89	Qvf	5.92-10.52	12.10	Sidegradient
25-89	Qvf	3.46-7.90	9.65	Sidegradient
26-89	Qvf	4.61-7.00	8.90	Sidegradient
27-89BR	Kcl	35.26-44.70	46.47	Sidegradient

TABLE 5-1 (cont.)

## BACKGROUND WELLS

Well No.	Zone of Completion	Screen Depth (ft)	Total Depth of Well (ft)	Comments
28-89BR	Kcl	35.00-44.47	46.00	Sidegradient
29-89BR	Kcl	31.00-40.50	41.25	Sidegradient
30-89BR	Kcl	29.70-39.16	40.94	Sidegradient
31-89BR	Kcl	27.05-36.55	37.30	Sidegradient
32-89BR	Kass	134.15-138.59	140.84	Sidegradient
33-89BR	Kass	107.00-111.43	113.90	Sidegradient
34-89BR	Kass	125.97-130.42	132.70	Sidegradient
35-89BR	Kass	106.50-112.90	115.23	Sidegradient
36-89BR	Kass	81.10-95.33	97.62	Sidegradient
37-89BR	Kass	64.40-66.49	90.95	Sidegradient
37-89P	Qvf	5.00-10.00	10.00	Sidegradient
38-89BR	Kass	105.50-109.95	112.22	Sidegradient
40-89BR	Kcl	14.66-24.14	25.90	Sidegradient
41-89BR	Kass	75.50-82.87	86.25	Sidegradient
42-89BR	Kcl	13.20-22.69	24.45	Sidegradient
43-89BR	Kass	41.24-45.67	48.00	Sidegradient
44-89BR	Kcl	15.18-25.00	26.00	Sidegradient
46-89	Qc	6.87-16.30	18.00	Sidegradient
47-89	Qrf	3.00-22.51	23.75	Sidegradient
48-89	Qrf	43.01-52.48	53.72	Sidegradient
49-89BR	Kass	36.04-45.50	46.75	Sidegradient
50-89BR	Qc	2.80-6.70	8.50	Sidegradient

Qrf = Rocky Flats Alluvium  
 Qc = Colluvium  
 Qvf = Valley Fill Alluvium  
 Kcl = Arapahoe Weathered Claystone  
 Kass = Arapahoe Sandstone

TABLE 5-2  
WEST SPRAY FIELD ALTERNATE MONITORING SYSTEM

Well Number	Zone of Completion	Screen Depth (ft)	Total Depth of well (ft)	Uppermost Aquifer?	Recommendation	Purpose
<u>EXISTING UPGRADEMENT WELLS</u>						
07-82	NA	NA	NA	Unknown	Abandon	Upgradient ground-water quality and water levels (2)
10-81	NA	NA	NA	Unknown	Abandon	Upgradient ground-water quality and water levels (2)
51-86	Alluvium (1)	4.83-79.06	79.06	Yes	Retain	Upgradient ground-water quality and water levels
52-86	Bedrock	92.00-125.80	125.65	No	Retain	Ground-water quality below uppermost aquifer; water levels for vertical gradients
<u>EXISTING MONITORING WELLS WITHIN WASTE MANAGEMENT AREA</u>						
05-82	NA	NA	NA	Unknown	Abandon	Plume definition and water levels within waste management area (2)
06-82	NA	NA	NA	Unknown	Abandon	Plume definition and water levels within waste management area (2)
48-86	Bedrock	191.99-207.07	207.07	Yes	Retain	MPW monitor well ground-water quality for sandstone which may subcrop within waste management unit; water levels for vertical gradients
49-86	Alluvium (1)	4.10-67.60	67.60	Yes	Retain	Plume definition and water levels within waste management area
50-86	Alluvium (1)	2.90-96.15	96.15	Yes	Retain	Plume definition and water levels within waste management area
SF7-89	Alluvium (3)	48.90-68.39	69.65	Yes	Retain	Plume definition and water levels within waste management area
SF8-89	Alluvium (3)	44.00-63.52	70.06	Yes	Retain	Plume definition and water levels within waste management area
<u>EXISTING DOWNGRADEMENT MONITORING WELLS</u>						
08-81	NA	NA	NA	Unknown	Abandon	Downgradient plume definition and water levels (2)
09-81	NA	NA	NA	Unknown	Abandon	Downgradient plume definition and water levels (2)
45-86	Alluvium (1)	2.99-48.20	48.20	Yes	Retain	Downgradient plume definition and water levels
46-86	Bedrock	140.33-160.79	160.79	No	Retain	Water quality below uppermost aquifer; water levels for vertical gradients
47-86	Alluvium (1)	6.23-94.49	94.49	Yes	Retain	Downgradient plume definition and water levels



TABLE 5-2 (cont.)  
WEST SPRAY FIELD ALTERNATE MONITORING SYSTEM

Well Number	Zone of Completion	Screen Depth (ft)	Total Depth of well (ft)	Uppermost Aquifer?	Recommendation	Purpose
<u>EXISTING DOWNGRADIENT MONITORING WELLS (cont.)</u>						
56-86	Alluvium (1)	2.60-9.60	9.60	Yes	Retain	Downgradient plume definition and water levels
SF-2	Alluvium	30.50-50.05	51.33	Yes	Retain	Point of compliance ground-water quality and water levels
SF4-89	Alluvium (1)	45.30-64.78	65.77	Yes	Retain	Point of compliance ground-water quality and water levels
SF5-89	Alluvium (1)	46.13-65.61	66.85	Yes	Retain	Point of compliance ground-water quality and water levels
SF6-89	Alluvium (3)	53.09-72.58	73.82	Yes	Retain	Point of compliance ground-water quality and water levels
<u>PROPOSED DOWNGRADIENT MONITORING WELLS FOR INSTALLATION IN 1989 (4)</u>						
SF-1	Alluvium	46.00-66.00	66.00	Yes	Install	Point of compliance ground-water quality and water levels
SF-3	Alluvium	40.00-60.00	60.00	Yes	Install	Point of compliance ground-water quality and water levels

- (1) Screened throughout saturated alluvium
- (2) Cannot assign data to uppermost aquifer
- (3) Screened at alluvial water table
- (4) Depths in proposed wells are approximate

HPW: Migration Path Way

NOTE: The two digit portion of the well number to the right of the hyphen indicates year of emplacement (07-82 was installed in 1982).

TABLE 5-3  
PRESENT LANDFILL ALTERNATE MONITORING SYSTEM

Well Number	Zone of Completion	Screen Depth (ft)	Total Depth of well (ft)	Uppermost Aquifer?	Recommendation	Purpose	Comments
<u>EXISTING UPGRADIENT WELLS</u>							
09-86	Bedrock	122.57-135.57	135.57	No	Retain	Upgradient ground-water quality and water levels	
10-86	Alluvium(1)	3.29-23.78	23.78	Yes	Retain	Upgradient ground-water quality and water levels	
58-87	Alluvium(1)	3.50-22.26	22.26	Yes	Retain	Upgradient ground-water quality and water levels	
WS-1	NA	NA	NA	Unknown	Abandon	Upgradient ground-water quality and water levels	(5)
<u>EXISTING MONITORING WELLS WITHIN WASTE MANAGEMENT AREA</u>							
07-86	Alluvium(1)	3.0-5.74	5.74	Yes	Retain	Plume definition within waste management area	Sometimes dry
08-86	Bedrock (sandstone)	59.08-63.79	63.80	Yes	Retain	MWP monitor well: ground-water quality and water levels	
59-87	Alluvium(1)	3.5-20.75	21.2	Yes	Abandon	Plume definition within waste management area	(6)
61-87	Alluvium(1)	3.5-28.24	28.5	Yes	Retain	Plume definition within waste management area	
62-87	Alluvium(1)	3.5-26.56	26.8	Yes	Retain	Plume definition within waste management area	
63-87	Alluvium(1)	3.5-25.40	25.5	Yes	Retain	Plume definition within waste management area	
64-87	Alluvium(2)	13.0-23.33	23.8	Yes	Retain	Plume definition within waste management area	
65-87	Alluvium(1)	10.7-23.96	24.2	Yes	Retain	Plume definition within waste management area	
68-87	Alluvium(2)	11.2-15.75	16.0	Yes	Retain	Plume definition within waste management area	
70-87	Alluvium(1)	3.5-16.26	16.5	Yes	Retain	Plume definition within waste management area	
LF1-89	Alluvium(1)	3.66-23.2	24.47	Yes	Retain	Plume definition within waste management area	
LF2-89BR	Bedrock (weathered claystone)	25.9-35.36	36.61	Yes	Retain	Plume definition within waste management area	
LF4-89	Alluvium	4.0-13.50	14.74	Yes	Retain	Plume definition within waste management area	
LF9-89BR	Bedrock (weathered claystone)	9.8-19.28	20.52	Yes	Retain	Plume definition within waste management area	

TABLE 5-3 (cont.)  
PRESENT LANDFILL ALTERNATE MONITORING SYSTEM

Well Number	Zone of Completion	Screen Depth (ft)	Total Depth of well (ft)	Uppermost Aquifer?	Recommendation	Purpose	Comments
<u>EXISTING SIDEGRADIENT MONITORING WELLS</u>							
60-87	Alluvium(1)	3.5-27.47	27.47	Yes	Retain	Point of compliance ground-water quality and water levels	
66-87	Alluvium(1)	3.4-17.96	17.96	Yes	Retain	Point of compliance ground-water quality and water levels	
67-87	Alluvium(1,7)	11.7-16.46	16.8	Yes	Retain	Point of compliance ground-water quality and water levels	
71-87	Alluvium(3)	3.50-13.51	13.51	Yes	Retain	Sidegradient plume definition and water levels.	
72-87	Alluvium(1,7)	3.5-8.76	7.00	Yes	Retain	Point of compliance ground-water quality and water levels.	Rarely dry
LF3-89BR	Bedrock(4) (siltstone)	32.37-41.82	43.05	Yes	Retain	Point of compliance ground-water quality and water levels.	
LF5-89BR	Alluvium/Bedrock (subcropping sandstone)	3.25-10.0	11.35	Yes	Retain	Point of compliance ground-water quality and water levels	
LF6-89BR	Bedrock(4) (sandstone)	23.5-35.14	36.24	Yes	Retain	Point of compliance ground-water quality and water levels	
LF8-89BR	Bedrock (weathered claystone)	8.7-18.17	19.41	Yes	Retain	Point of compliance ground-water quality and water levels	
LF10-89BR	Bedrock (weathered claystone)	8.0-17.45	18.20	Yes	Retain	Point of compliance ground-water quality and water levels	
LF14-89BR	Bedrock (weathered claystone)	5.20-14.65	15.89	Yes	Retain	Point of compliance ground-water quality and water levels.	
<u>EXISTING DOWNGRADIENT MONITORING WELLS</u>							
40-87	Alluvium(1)	3.50-6.46	6.46	Yes	Retain	Point of compliance ground-water quality and water levels.	Sometimes dry
41-87	Bedrock(4) (sandstone)	81.21-93.79	93.79	Yes	Retain	Point of compliance ground-water quality and water levels.	
42-87	Alluvium (1,7)	3.00-6.36	6.60	Yes	Retain	Downgradient plume definition and water levels.	Sometimes dry

TABLE 5-3 (cont.)  
PRESENT LANDFILL ALTERNATE MONITORING SYSTEM

Well Number	Zone of Completion	Screen Depth (ft)	Total Depth of well (ft)	Uppermost Aquifer?	Recommendation	Purpose	Comments
<u>EXISTING DOWNGRADIENT MONITORING WELLS</u>							
LF11-89BR	Bedrock (weathered claystone)	11.8-21.3	22.50	Yes	Retain	Point of compliance ground-water quality and water levels.	
LF12-89BR	Bedrock (siltstone and sandstone)	31.32-53.0	54.0	Yes	Retain	Point of compliance ground-water quality and water levels.	
LF13-89BR	Bedrock(4) (siltstone)	70.98-75.43	77.76	Yes	Retain	Point of compliance ground-water quality and water levels	
<p>(1) Screened throughout saturated alluvium</p> <p>(2) Screened below water table</p> <p>(3) Screened at water table</p> <p>(4) Monitors sandstone which subcrops within waste management area</p> <p>(5) Cannot assign data to uppermost aquifer.</p> <p>(6) Well penetrates the clay surface seal of the ground-water leachate system.</p> <p>(7) Water table is sometimes above top of screen.</p>							
MPW:	Migration Path Way						
Note:	The two digit portion of the well number to the right of the hyphen indicates year of emplacement (09-86 was installed in 1986).						

TABLE 5-4  
SOLAR EVAPORATION PONDS ASSESSMENT MONITORING SYSTEM

Well Number	Zone of Completion	Screen Depth (ft)	Total Depth of well (ft)	Uppermost Aquifer?	Recommendation	Purpose	Comments
<u>EXISTING UPGRADIENT WELLS</u>							
SEP20-89	Alluvium	8.20-12.66	13.4	Yes	Retain	Upgradient background water quality and water levels	
SEP21-89BR	Bedrock (subcropping sandstone)	16.82-28.80	30.05	Yes	Retain	Upgradient background water quality and water levels	
<u>EXISTING MONITOR WELLS WITHIN WASTE MANAGEMENT AREA</u>							
2-60	NA	NA	NA	NA	Abandon	Plume definition and water levels within waste management area	(2)
20-86	Alluvium(1)	4.21-10.55	10.55	Yes	Retain	Plume definition and water levels within waste management area	Usually dry
22-86	Alluvium(1)	3.20-11.20	11.20	Yes	Retain	Plume definition and water levels within waste management area	
27-86	Bedrock (sandstone)	128.50-133.00	133.00	No	Retain	Plume definition in underlying sandstone; water levels for vertical gradients	
28-86	Alluvium(3)	4.03-8.60	8.60	Yes	Retain	Plume definition and water levels within waste management area	
30-86	Bedrock (weathered claystone)	2.48-14.93	14.93	Yes	Retain	Plume definition and water levels within waste management area	
32-86	Bedrock (sandstone)	114.90-125.50	125.50	No	Retain	Plume definition in underlying sandstone; water levels for vertical gradients	
37-87	Alluvium(1)	3.50-8.77	9.00	Yes	Retain	Plume definition and water levels within waste management area	
39-87	Bedrock (sandstone)	109.99-117.14	117.39	No	Retain	Plume definition in underlying sandstone; water levels for vertical gradients	
56-87	Alluvium(4)	3.52-9.60	9.60	Yes	Retain	Plume definition and water levels within waste management area	
SLP16-89BR	Bedrock (sandstone)	67.76-96.94	99.16	Yes	Retain	MPW monitor well: ground-water quality and water levels in sandstone which may subcrop in waste management	
SEP17-89BR	Bedrock (weathered sandstone)	15.40-24.84	26.12	Yes	Retain	Plume definition and water levels within waste management area	
SEP18-89BR	Bedrock (weathered sandstone)	16.50-25.96	27.21	Yes	Retain	Plume definition and water levels within waste management area	

TABLE 5-4 (cont.)  
SOX AR EVAPORATION POND ASSESSMENT MONITORING SYSTEM

Well Number	Zone of Completion	Screen Depth (ft)	Total Depth of well (ft)	Uppermost Aquifer?	Recommendation	Purpose	Comments
<u>EXISTING MONITOR WELLS WITHIN WASTE MANAGEMENT AREA (cont.)</u>							
SEP22-89BR	Bedrock (weathered sandstone)	15.48-35.0	36.25	Yes	Retain	Plume definition and water levels within waste management area	
SEP23-89BR	Bedrock (weathered claystone)	9.07-18.52	18.77	Yes	Retain	Plume definition and water levels within waste management area	
SEP24-89BR	Bedrock (weathered claystone)	17.20-26.67	27.93	Yes	Retain	Plume definition and water levels within waste management area	
SEP25-89	Alluvium	3.00-12.50	13.75	Yes	Retain	Plume definition and water levels within waste management area	
SEP26-89BR	Bedrock (weathered claystone)	8.89-18.83	19.63	Yes	Retain	Plume definition and water levels within waste management area	
SEP30-89BR	Bedrock (weathered sandstone)	20.40-36.50	37.13	Yes	Retain	Plume definition and water levels within waste management area	
SEP31-89BR	Bedrock (weathered sandstone)	11.57-21.00	22.27	Yes	Retain	Plume definition and water levels within waste management area	
<u>EXISTING SIDEGRADIENT MONITOR WELLS</u>							
23-86	Bedrock (sandstone)	113.0-117.25	117.00	No	Retain	Plume definition in underlying sandstone; water levels for vertical gradients	
24-86	Alluvium(1)	2.95-7.25	7.45	Yes	Retain	Sidegradient plume definition and water levels	Often dry
SEP1-89BR	Bedrock (sandstone)	10.53-15.18	16.22	Yes	Retain	Sidegradient plume definition and water levels	
SEP2-89	Alluvium	2.39-7.00	8.23	Yes	Retain	Sidegradient plume definition and water levels	
SEP15-89	Valley Fill	2.88-10.93	12.29	Yes	Retain	Sidegradient plume definition and water levels	
4-60	NA	NA	NA	NA	Abandon	Downgradient plume definition and water levels	(2)
13-86	Alluvium(1)	3.09-9.50	9.50	Yes	Retain	Downgradient plume definition and water levels	
14-86	Bedrock (sandstone)	39.42-55.36	55.36	No	Retain	Downgradient plume definition in underlying sandstone; water levels for vertical gradient	

TABLE 5-4 (cont.)  
SOLAR EVAPORATION POND ASSESSMENT MONITORING SYSTEM

Well Number	Zone of Completion	Screen Depth (ft)	Total Depth of well (ft)	Uppermost Aquifer?	Recommendation	Purpose	Comments
<u>EXISTING SIDEGRADIENT MONITOR WELLS (cont.)</u>							
15-86	Alluvium/Bedrock (weathered claystone)	4.09-14.69	14.69	Yes	Retain	Downgradient plume definition and water levels	
16-86	Bedrock (siltstone & sandstone)	39.06-45.06	45.06	No	Retain	Downgradient plume definition; water levels for vertical gradients	
17-86	Alluvium(1)	3.73-13.98	13.98	Yes	Retain	Downgradient plume definition and water levels	
18-86	Alluvium(1)	3.74-7.50	7.50	Yes	Retain	Downgradient plume definition water levels	
21-87	Alluvium(1)	3.23-10.40	10.56	Yes	Retain	Downgradient plume definition water levels	
22-87	Bedrock (sandstone)	81.41-88.46	88.70	No	Retain	Downgradient plume definition in underlying sandstone; water levels for vertical gradients	Often dry
25-86	Bedrock (sandstone)	59.90-82.00	82.00	Yes	Retain	Point of compliance ground-water quality in underlying sandstone; water levels for vertical gradients	
26-86	Alluvium(1)	3.75-11.00	11.00	Yes	Retain	Point of compliance ground-water quality and water levels	
29-86	Alluvium(1)	2.83-8.77	8.77	Yes	Retain	Downgradient plume definition and water levels	Often dry
33-86	Alluvium	2.99-7.34	7.34	Yes	Retain	Downgradient plume definition and water levels	Dry
34-86	Bedrock (sandstone)	44.24-56.25	56.25	No	Retain	Downgradient plume definition in underlying sandstone; water levels for vertical gradients	
35-86	Alluvium(1)	4.86-11.60	11.60	Yes	Retain	Downgradient plume definition and water levels	
36-86	Alluvium(1)	3.50-6.49	6.50	Yes	Retain	Downgradient plume definition and water levels	Sometimes Dry
38-87	Alluvium/Bedrock (weathered claystone)	3.50-9.27	9.50	Yes	Retain	Point of compliance ground-water quality and water levels	Sometimes Dry
SEP3-89BR	Bedrock (weathered claystone)	14.40-23.86	25.10	Yes	Retain	Point of compliance ground water quality and water levels	
SEP4-89	Alluvium	3.64-13.10	14.36	Yes	Retain	Point of compliance ground water quality and water levels	
SEP5-89BR	Bedrock (weathered claystone)	17.90-27.34	28.63	Yes	Retain	Point of compliance ground-water quality and water levels	

TABLE 5-4 (CONT.)  
SOLAR EVAPORATION PONDS ASSESSMENT MONITORING SYSTEM

Well Number	Zone of Completion	Screen Depth (ft)	Total Depth of well (ft)	Uppermost Aquifer?	Recommendation	Purpose	Comments
<u>EXISTING DOWNGRADIENT MONITOR WELLS (CONT.)</u>							
SEP6-89	Alluvium	3.26-7.70	8.95	Yes	Retain	Point of compliance ground-water quality and water levels	
SEP7-89	Bedrock (weathered claystone)	11.00-20.48	21.73	Yes	Retain	Point of compliance ground-water quality and water levels	
SEP8-89	Colluvium	3.40-12.90	14.16	Yes	Retain	Point of compliance ground-water quality and water levels	
SEP9-89BR	Bedrock (weathered claystone)	16.90-26.34	27.58	Yes	Retain	Point of compliance ground-water quality and water levels	
SEP10-89BR	Bedrock (weathered claystone)	5.95-15.42	16.16	Yes	Retain	Point of compliance ground-water quality and water levels	
SEP11-89	Colluvium	3.37-7.30	9.03	Yes	Retain	Downgradient plume definition and water levels	
SEP12-89BR	Bedrock (weathered claystone)	19.76-29.22	30.49	Yes	Retain	Downgradient plume definition and water levels	
SEP13-89	Valley Fill	3.23-3.99	5.07	Yes	Retain	Downgradient plume definition and water levels	
SEP14-89BR	Bedrock (weathered claystone)	12.32-21.80	23.07	Yes	Retain	Downgradient plume definition and water levels	
SEP28-89	Colluvium	3.81-8.18	9.58	Yes	Retain	Point of compliance ground-water quality and water levels	
SEP29-89BR	Bedrock (weathered claystone)	12.20-21.50	22.93	Yes	Retain	Point of compliance ground-water quality and water levels	
SEP32-89BR	Bedrock (weathered claystone)	13.61-23.07	24.35	Yes	Retain	Downgradient plume definition and water levels	
SEP33-89	Colluvium	2.98-7.41	8.67	Yes	Retain	Downgradient plume definition and water levels	

- (1) Screened throughout saturated alluvium  
(2) Cannot assign data to uppermost aquifer  
(3) Screened below water table  
(4) Screened at alluvial water table

MUP: Migration Path Map



TABLE 5-5  
PIEZOMETER WELL SERIES

<u>Well No.</u>	<u>Screen (ft.)</u>	<u>Status</u>	<u>Fm</u>
PZ1389	2.46-6.90	Drilled	Qc
PZ1489	11.30-20.83	Drilled	Kass (a subcropping sandstone)
PZ3689	44.00-48.80	Drilled	Qrf
PZ3789	32.54-36.50	Drilled	Qrf
PZ4589	33.59-38.00	Drilled	Qrf
PZ4689	36.27-40.70	Drilled	Qrf
PZ4789	31.29-35.71	Drilled	Qrf
PZ5189	16.23-20.20	Drilled	Qrf
PZ5389	38.75-43.20	Drilled	Qrf
PZ5589	29.24-34.00	Drilled	Qrf
PZ5889	25.69-30.10	Drilled	Qrf

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Piezometer series wells are currently being installed. See Plate 2-1 for locations.

Qc = Colluvium  
 Kass = Arapahoe Alluvium  
 Qrf = Rocky Flats Alluvium

All piezometer series wells have been completed within the upper aquifer.

hazardous wastes were spray irrigated in this area over the period April 1982 to October 1985. Results of hydrologic investigations suggest that spray application of liquids may have resulted in elevated levels of nitrate in downgradient alluvial ground water. Sulfate and sodium ions were also elevated above background concentrations. Total dissolved solids (TDS), barium, iron, manganese, and strontium concentrations are generally higher at locations downgradient of the site. Total uranium was detected in one well in 1988. A twenty-one well alternate interim status ground water monitoring program is in effect. These wells are tabulated in Table 5-2 and their locations are shown in Figure 5-1.

## 5.2 PRESENT LANDFILL ALTERNATE MONITORING SYSTEM

The present landfill is located on the western end of an unnamed tributary to North Walnut Creek. The landfill began operation in August 1968 and was scheduled to cease receiving solid wastes in June 1989. In July 1988 the landfill encompassed approximately 765,000 square feet. Historical records indicate some hazardous waste was disposed of at the landfill, thus qualifying it as a RCRA-regulated unit. A 35-well (Table 5-3, Figure 5-2) alternate interim status ground-water monitoring program is in effect at the Present Landfill.

Based on the results of ground water monitoring to date, a contaminant plume has not been identified but it appears the landfill may be impacting downgradient ground water in the alluvial aquifer with major ions, manganese and iron. Levels of strontium and barium are also elevated relative to upgradient locations in the alluvial aquifer downgradient of the landfill and gross alpha, beta, and total uranium exceed proposed concentration limits in one well (Rockwell International, 1989a). Three bedrock wells in this area contain concentrations of barium, molybdenum, sodium, strontium, uranium, sulfate, and TDS elevated above ground levels.

### 5.3 SOLAR EVAPORATION PONDS ASSESSMENT MONITORING SYSTEM

The Solar Evaporation Ponds are located on the northeast side of the Perimeter Security Zone at the RFP. The Solar Ponds were used to store and treat mixed wastes, primarily low level radioactive wastes containing high nitrates, and are therefore RCRA-regulated units. Various ponds were put into service between 1956 and 1970. The pond liquids and sludges contain elevated concentrations of aluminum, chromium, copper, iron, potassium, sodium, nickel, tin, plutonium, americium, uranium, tritium, and nitrates. Pond liquids were moderately to highly alkaline. The ponds are currently undergoing RCRA closure.

Downgradient alluvial ground water contaminants include major ions, nitrate, uranium, tritium, and trace metal. Sulfate, TDS, sulfate, chloride, nitrate, uranium, and volatile organic compounds all occur above proposed concentration limits within the Solar Ponds area.

Ground water within shallow sandstone bedrock units also appears to have been impacted by the ponds. Contaminants that have been encountered in wells constructed in shallow sandstone include major ions, metals, and uranium. The Solar Evaporation Ponds Assessment Monitoring Program consists of 50 monitoring wells (Table 5-4, Figure 5-3).

### 5.4 ORIGINAL PROCESS WASTE LINES MONITORING SYSTEM AND PIEZOMETER SERIES WELLS

The monitoring network for the Original Process Waste Lines is not yet in place. The location of the Original Process Waste Lines and of the existing and proposed wells in the vicinity of the lines are shown on Plate 5-2. Currently, (as of September 1, 1989) the Piezometer Series of wells are being installed (Piezometer Series Wells are identified by the prefix PZ). All existing piezometer series wells are tabulated in Table 5-5. Wells PZ 1-89 through PZ 26-89 will be installed as part of a monitoring system for the Old Process Waste Lines. Wells PZ 27-89 through PZ 63-89 will be installed to better characterize the water table in the western half of the main plant area.

## SECTION 6.0

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**APPENDIX 1**  
**WASTE MANAGEMENT UNITS AT**  
**ROCKY FLATS PLANT**

## WASTE MANAGEMENT UNITS AT ROCKY FLATS PLANT

OTHER REFERENCE NUMBER	REFERENCE NUMBERS	BLDG. NUMBER	UNIT NAME	REGULATORY STATUS	CURRENT STATUS
73		774	TRU Drum Storage Area, Room 241	Interim Status?	Active
101			207 SOLAR EVAPORATION PONDS	Inactive RCRA Unit, Post Closure Care Required	Closure Plan Submitted
102			OIL SLUDGE PIT	CERCLA Unit	Phase II RI Complete
103			CHEMICAL BURIAL	CERCLA Unit	Phase II RI Complete
104			LIQUID DUMPING	CERCLA Unit	Phase II RI Complete
105			OUT-OF-SERVICE FUEL TANKS		
105.1			WESTERNMOST TANK	CERCLA Unit	Phase II RI Complete
105.2			EASTERNMOST TANK	CERCLA Unit	Phase II RI Complete
106			OUTFALL	CERCLA Unit	Phase II RI Complete
107			HILLSIDE OIL LEAK	CERCLA Unit	Phase II RI Complete
108			TRENCH T-1	CERCLA Unit	Phase II RI Complete
109			TRENCH T-2	CERCLA Unit	Phase II RI Complete
110			TRENCH T-3	CERCLA Unit	Phase II RI Complete
111			TRENCHES T-4 TO T-11	CERCLA Unit	Phase II RI Work Plans Submitted
111.1			TRENCH T-4	CERCLA Unit	Phase II RI Work Plans Submitted
111.2			TRENCH T-5	CERCLA Unit	Phase II RI Work Plans Submitted
111.3			TRENCH T-6	CERCLA Unit	Phase II RI Work Plans Submitted
111.4			TRENCH T-7	CERCLA Unit	Phase II RI Work Plans Submitted
111.5			TRENCH T-8	CERCLA Unit	Phase II RI Work Plans Submitted
111.6			TRENCH T-9	CERCLA Unit	Phase II RI Work Plans Submitted
111.7			TRENCH T-10	CERCLA Unit	Phase II RI Work Plans Submitted
111.8			TRENCH T-11	CERCLA Unit	Phase II RI Work Plans Submitted
112			903 DRUM STORAGE AREA	CERCLA Unit	Phase II RI Work Plans Submitted
113			MOUND AREA	CERCLA Unit	Phase II RI Work Plans Submitted
114			PRESENT LANDFILL	Inactive RCRA Unit, Post Closure Care Required	Closure Plan Submitted
115			ORIGINAL LANDFILL	CERCLA Unit	Investigation Work Plan Submitted
116			MULTIPLE SOLVENT SPILLS		
116.1			WEST LOADING DOCK AREA	CERCLA Unit	Investigation Work Plan Submitted



## WASTE MANAGEMENT UNITS AT ROCKY FLATS PLANT

OTHER REFERENCE NUMBER	REFERENCE NUMBERS	BLDG. NUMBER	UNIT NAME	REGULATORY STATUS	CURRENT STATUS
116.2			SOUTH LOADING DOCK AREA	CERCLA Unit	Investigation Work Plan Submitted
117			CHEMICAL STORAGE		Inactive
117.1			NORTH SITE	CERCLA Unit	Investigation Work Plan Submitted
117.2			MIDDLE SITE		Inactive
117.3			SOUTH SITE		
118			MULTIPLE SOLVENT SPILLS		
118.1			WEST OF BUILDING 730	CERCLA Unit	Investigation Work Plan Submitted
118.2			SOUTH END OF BUILDING 776	CERCLA Unit	Investigation Work Plan Submitted
119			MULTIPLE SOLVENT SPILLS		
119.1			WEST AREA	CERCLA Unit	Phase II RI Complete
119.2			EAST AREA	CERCLA Unit	Phase II RI Complete
120			FIBERGLASSING AREAS		
120.1			NORTH OF BUILDING 664		Investigation Work Plan Submitted
120.2			WEST OF BUILDING 664		Investigation Work Plan Submitted
121			ORIGINAL PROCESS WASTE LINES	Inactive RCRA Unit Post Closure Care Required	Closure Plan Submitted
122			UNDERGROUND CONCRETE TANK		Included in OPWL Closure Plan
123			VALVE VAULT 7		
123.1	40.56		VALVE VAULT 7	Interim Status	Closure Plan in Operating Permit
123.2			VALVE VAULT WEST OF BUILDING 707		Included in OPWL Closure Plan
124			RADIOACTIVE LIQUID WASTE STORAGE TANKS		
124.1	55.16		30,000 GALLON TANK (#68)	Inactive RCRA Unit	Closure Plan Under Preparation
124.2	55.14		14,000 GALLON TANK (#66)	Inactive RCRA Unit	Closure Plan Under Preparation
124.3	55.15		14,000 GALLON TANK (#67)	Inactive RCRA Unit	Closure Plan Under Preparation
125			HOLDING TANK (Same as Unit 124.2)		
126			OUT-OF-SERVICE PROCESS WASTE TANKS		
126.1			WESTERNMOST TANK	Inactive RCRA Unit	Included in OPWL Closure Plan
126.2			EASTERNMOST TANK	Inactive RCRA Unit	Included in OPWL Closure Plan
127			LOW-LEVEL RADIOACTIVE WASTE LEAK		Inactive
128			OIL BURN PIT NO. 1	CERCLA Unit	Investigation Work Plan Submitted

## WASTE MANAGEMENT UNITS AT ROCKY FLATS PLANT

REFERENCE NUMBER	OTHER REFERENCE NUMBERS	BLDG. NUMBER	UNIT NAME	REGULATORY STATUS	CURRENT STATUS
129			OIL LEAK	Inactive RCRA Unit	Included 443 Tank Closure Plan
130			RADIOACTIVE SITE - 800 AREA SITE #1	CERCLA Unit	Phase II RI Complete
131			RADIOACTIVE SITE - 700 AREA SITE #1	CERCLA Unit	Investigation Work Plan Submitted
132			RADIOACTIVE SITE - 700 AREA SITE #4	Inactive RCRA Unit	Included in OPWL Closure Plan
133			ASH PITTS		
133.1			ASH PIT 1-1	CERCLA Unit	Investigation Work Plan Submitted
133.2			ASH PIT 1-2	CERCLA Unit	Investigation Work Plan Submitted
133.3			ASH PIT 1-3	CERCLA Unit	Investigation Work Plan Submitted
133.4			ASH PIT 1-4	CERCLA Unit	Investigation Work Plan Submitted
133.5			INCINERATOR		Investigation Work Plan Submitted
133.6			CONCRETE WASH PAD		Investigation Work Plan Submitted
134			LITHIUM METAL DESTRUCTION SITE	CERCLA Unit	Investigation Work Plan Submitted
135			COOLING TOWER BLOWDOWN	CERCLA Unit	Investigation Work Plan Submitted
136			COOLING TOWER PONDS		Investigation Work Plans Submitted
136.1			NORTHEAST CORNER OF BUILDING 460	CERCLA Unit	Investigation Work Plans Submitted
136.2			WEST OF BUILDING 460	CERCLA Unit	Investigation Work Plans Submitted
136.3			S OF BLDG 460, W OF BLDG 444	CERCLA Unit	Investigation Work Plans Submitted
137			COOLING TOWER BLOWDOWN - BLDG 774	Inactive RCRA Unit	Included in OPWL Closure Plan
138			COOLING TOWER BLOWDOWN - BLDG 779	Inactive RCRA Unit Post Closure Care Required	Included in Solar Pond Closure Plan
139			CAUSTIC/ACID SPILLS		
139.1			HYDROXIDE TANK AREA		Investigation Work Plan Submitted
139.2			HYDROFLUORIC ACID TANKS		Investigation Work Plan Submitted
140			REACTIVE METAL DESTRUCTION SITE		Phase II Works Plan Submitted
141			SLUDGE DISPERSAL	CERCLA Unit	Investigation Work Plan Submitted
142			RETENTION PONDS (A, B, C-SERIES)		
142.01			A-1 POND	CERCLA Unit	Investigation Work Plan Submitted
142.02			A-2 POND	CERCLA Unit	Investigation Work Plan Submitted
142.03			A-3 POND	CERCLA Unit	Investigation Work Plan Submitted
142.04			A-4 POND	CERCLA Unit	Investigation Work Plan Submitted

# WASTE MANAGEMENT UNITS AT ROCKY FLATS PLANT

REFERENCE NUMBER	OTHER REFERENCE NUMBERS	BLDG. NUMBER	UNIT NAME	REGULATORY STATUS	CURRENT STATUS
142.05			B-1 POND	CERCLA Unit	Investigation Work Plan Submitted
142.06			B-2 POND	CERCLA Unit	Investigation Work Plan Submitted
142.07			B-3 POND	CERCLA Unit	Investigation Work Plan Submitted
142.08			B-4 POND	CERCLA Unit	Investigation Work Plan Submitted
142.09			B-5 POND	CERCLA Unit	Investigation Work Plan Submitted
142.10			C-1 POND	CERCLA Unit	Investigation Work Plan Submitted
142.11			C-2 POND	CERCLA Unit	Investigation Work Plan Submitted
142.12			Flume Pond	CERCLA Unit	Investigation Work Plan Submitted
143			OLD OUTFALL	Inactive RCRA Unit	Investigation Work Plan Submitted
144			SEWER LINE BREAK	CERCLA Unit	Included in OPWL Closure Plan
145			SANITARY WASTE LINE LEAK		Phase II RI Complete
146			CONCRETE PROCESS WASTE TANKS		
146.1			7,500 GALLON TANK (#31)	Inactive RCRA Unit	Included in OPWL Closure Plan
146.2			7,500 GALLON TANK (#32)	Inactive RCRA Unit	Included in OPWL Closure Plan
146.3			7,500 GALLON TANK (#34W)	Inactive RCRA Unit	Included in OPWL Closure Plan
146.4			7,500 GALLON TANK (#34E)	Inactive RCRA Unit	Included in OPWL Closure Plan
146.5			3,750 GALLON TANK (#30)	Inactive RCRA Unit	Included in OPWL Closure Plan
146.6			3,750 GALLON TANK (#33)	Inactive RCRA Unit	Included in OPWL Closure Plan
147			PROCESS WASTE LEAKS		
147.1			MAAS AREA	Inactive RCRA Unit	Included in OPWL Closure Plan
147.2			OWEN AREA	Inactive RCRA Unit	Included in OPWL Closure Plan
148			WASTE SPILLS	CERCLA Unit	Investigation Work Plan Submitted
149			EFFLUENT PIPE	Inactive RCRA Unit Post Closure Care Required	Inactive
150			RADIOACTIVE LIQUID LEAKS (8)		
150.1			NORTH OF BUILDING 771	Inactive RCRA Unit	Included in OPWL Closure Plan
150.2			WEST OF BUILDING 771		Inactive
150.3			BETWEEN BUILDINGS 771 AND 774		Inactive
150.4			EAST OF BUILDING 750		Inactive
150.5			WEST OF BUILDING 707	Inactive RCRA Unit	Included in OPWL Closure Plan

## WASTE MANAGEMENT UNITS AT ROCKY FLATS PLANT

REFERENCE NUMBER	REFERENCE NUMBERS	BLDG. NUMBER	UNIT NAME	REGULATORY STATUS	CURRENT STATUS
150.6			SOUTH OF BUILDING 779	Inactive RCRA Unit	Included in OPWL Closure Plan
150.7			SOUTH OF BUILDING 776	Inactive RCRA Unit	Included in OPWL Closure Plan
150.8			NORTHEAST OF BUILDING 779	Inactive RCRA Unit Post Closure Care Required	Included in Solar Plan Closure Plan
151			FUEL OIL LEAK		Investigation Work Plan Submitted
152			FUEL OIL TANK		Investigation Work Plan Submitted
153			OIL BURN PIT NO. 2	CERCLA Unit	Investigation Work Plan Submitted
154			PALLET BURN SITE	CERCLA Unit	Investigation Work Plan Submitted
155			903 LIP AREA	CERCLA Unit	Investigation Work Plan Submitted
156			RADIOACTIVE SOIL BURIAL		
156.1			BUILDING 334 PARKING LOT	CERCLA Unit	Investigation Work Plan Submitted
156.2			SOIL DUMP AREA	CERCLA Unit	Investigation Work Plan Submitted
157			RADIOACTIVE SITE		
157.1			NORTH AREA		
157.2			SOUTH AREA		
158			RADIOACTIVE SITE - BLDG 551	CERCLA Unit	Investigation Work Plan Submitted
159			RADIOACTIVE SITE - BLDG 559	CERCLA Unit	Investigation Work Plan Submitted
160			RADIOACTIVE SITE - BLDG 444 PK LOT	CERCLA Unit	Investigation Work Plan Submitted
161			RADIOACTIVE SITE - BLDG 664	CERCLA Unit	Investigation Work Plan Submitted
162			RADIOACTIVE SITE - 700 AREA SITE #2	Inactive RCRA Unit	Included in OPWL Closure Plan
163			RADIOACTIVE SITE - 700 AREA SITE #3	CERCLA Unit	Investigation Work Plan Submitted
163.1			WASH AREA	CERCLA Unit	Investigation Work Plan Submitted
163.2			BURIED SLAB		Investigation Work Plan Submitted
164			RADIOACTIVE SITE - 800 AREA SITE #2		
164.1			CONCRETE SLAB		Investigation Work Plan Submitted
164.2			BUILDING 886 SPILLS		Investigation Work Plan Submitted
164.3			BUILDING 889 STORAGE PAD		Investigation Work Plan Submitted
165			TRIANGLE AREA	CERCLA Unit	Investigation Work Plans Submitted
166			TRENCHES		
166.1			TRENCH A	CERCLA Unit	Investigation Work Plans Submitted

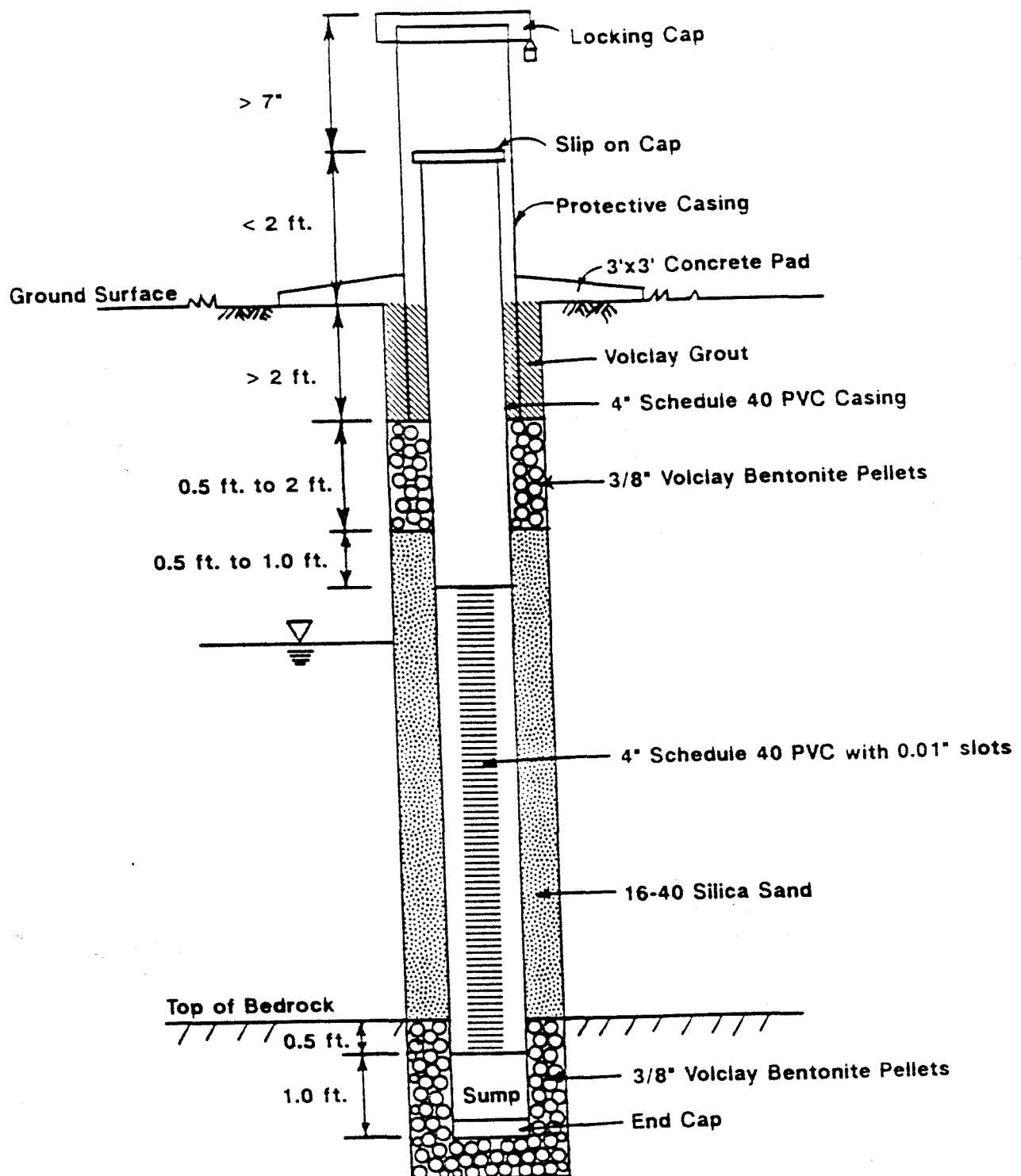
## WASTE MANAGEMENT UNITS AT ROCKY FLATS PLANT

REFERENCE NUMBER	OTHER REFERENCE NUMBERS	BLDG. NUMBER	UNIT NAME	REGULATORY STATUS	CURRENT STATUS
166.2			TRENCH B	CERCLA Unit	Investigation Work Plans Submitted
166.3			TRENCH C	CERCLA Unit	Investigation Work Plans Submitted
167			SPRAY FIELDS - THREE SITES		
167.1			NORTH AREA	Inactive RCRA Unit	Included in Landfill Closure Plan
167.2			POND AREA	Inactive RCRA Unit	Included in Landfill Closure Plan
167.3			SOUTH AREA	Inactive RCRA Unit	Included in Landfill Closure Plan
168			WEST SPRAY FIELD	Inactive RCRA Unit Post Closure Care Required	Closure Plan Submitted
169			WASTE DRUM PEROXIDE BURIAL	CERCLA Unit	Investigation Work Plan Submitted
170			P.U. & D. STORAGE YARD - WASTE SPILLS		Inactive
171			SOLVENT BURNING GROUND		Investigation Work Plan Submitted
172			CENTRAL AVENUE WASTE SPILL		Investigation Work Plan Submitted
173			RADIOACTIVE SITE - 900 AREA	CERCLA Unit	Investigation Work Plan Submitted
174			P.U. & D. CONTAINER STORAGE FACILITIES (2)	Inactive RCRA Unit	Closure Plan Submitted
175			S&W BLDG 980 CONTAINER STORAGE FACILITY	Inactive RCRA Unit	Closure Plan Submitted
176			S&W CONTRACTOR STORAGE YARD	Inactive RCRA Unit	Closure Plan Submitted
177			BUILDING 885 DRUM STORAGE AREA	Inactive RCRA Unit	Closure Plan Submitted
178			BUILDING 881 DRUM STORAGE AREA	Inactive RCRA Unit	Closure Plan Submitted
179			BUILDING 865 DRUM STORAGE AREA	Inactive RCRA Unit	Closure Plan Submitted
180			BUILDING 883 DRUM STORAGE AREA	Inactive RCRA Unit	Closure Plan Submitted
181			BUILDING 334 CARGO CONTAINER AREA	Inactive RCRA Unit	Closure Plan Submitted
182			BUILDING 444/453 DRUM STORAGE AREA	Inactive RCRA Unit	Closure Plan Submitted
183			GAS DETOXIFICATION AREA	CERCLA Unit	Closure Plan Submitted
184			BUILDING 991 STEAM CLEANING AREA	CERCLA Unit	Phase II RI Work Plans Submitted
185			SOLVENT SPILL		Investigation Work Plan Submitted
186			VALVE VAULT 12		Investigation Work Plan Submitted
187		40.61	ACID LEAKS (2)	Active	Closure Plan in Operating Permit
188			ACID LEAK		Investigation Work Plan Submitted
189			MULTIPLE ACID SPILLS		Investigation Work Plan Submitted
190			CAUSTIC LEAK		Investigation Work Plan Submitted

## WASTE MANAGEMENT UNITS AT ROCKY FLATS PLANT

REFERENCE NUMBER	REFERENCE NUMBERS	OTHER	REFERENCE BLDG. NUMBER	UNIT NAME	REGULATORY STATUS	CURRENT STATUS
191				HYDROGEN PEROXIDE SPILL		Investigation Work Plan Submitted
192				ANTIFREEZE DISCHARGE		Investigation Work Plan Submitted
193				STEAM CONDENSATE LEAK		Investigation Work Plan Submitted
194				STEAM CONDENSATE LEAK		Investigation Work Plan Submitted
195				NICKEL CARBONYL DISPOSAL		Investigation Work Plan Submitted
196				WATER TREATMENT PLANT BACKWASH POND		Investigation Work Plan Submitted
197				SCRAP METAL SITES	CERCLA Unit	Investigation Work Plan Submitted
198				VOCS IN GROUND WATER	Covered by ER Program	Covered by ER Program
199				CONTAMINATION OF THE LAND'S SURFACE	CERCLA Unit	Investigation Work Plan Submitted
200				GREAT WESTERN RESERVOIR		Investigation Work Plan Submitted
201				STANDLEY RESERVOIR		Investigation Work Plan Submitted
202				MOWER RESERVOIR		Investigation Work Plan Submitted
203	1			INACTIVE HAZARDOUS WASTE STORAGE AREA	Inactive RCRA Unit	Closure Plan Submitted
204	45			ORIGINAL URANIUM CHIP ROASTER	Interim Status Until Closure is Certified	Closure Plan Submitted
205	1278			BLDG 460 SUMP #3 ACID SIDE	Inactive RCRA Unit	Inactive
206	42.14			INACTIVE D-836 HAZARDOUS WASTE TANK	Inactive RCRA Unit	Included in OPWL Closure Plan
207	4			INACTIVE 444 ACID DUMPSTER	Interim Status Until Closure is Certified	Closure Plan Submitted
208	3			INACTIVE 444/447 WASTE STORAGE AREA	Interim Status Until Closure is Certified	Inactive
305	111			5 Gallon Container Solvent	Satellite Accumulation Area	Active
306	111			Drum for Solvent Containing Wipes	Satellite Accumulation Area	Active
307	111			30 Gallon Drum of Metal Plates	Non-Hazardous Waste Unit	Active
308	111			Fixer Container-Silver Recovery	Precious Metal Recovery	Active
309	121			Drum for Solvent Containing Wipes	Satellite Accumulation Area	Active
310	121			Classified Incinerator	Non-Hazardous Waste Unit	Active
312	122			10 Gallon Carboy Fixer	Precious Metal Recovery	Active
313	123			Toluene Bottle	Satellite Accumulation Area	Active
314	123			Toluene Collection Bottles	Satellite Accumulation Area	Active

**APPENDIX 2**  
**TYPICAL RFP WELL CONSTRUCTION**  
**DIAGRAMS**



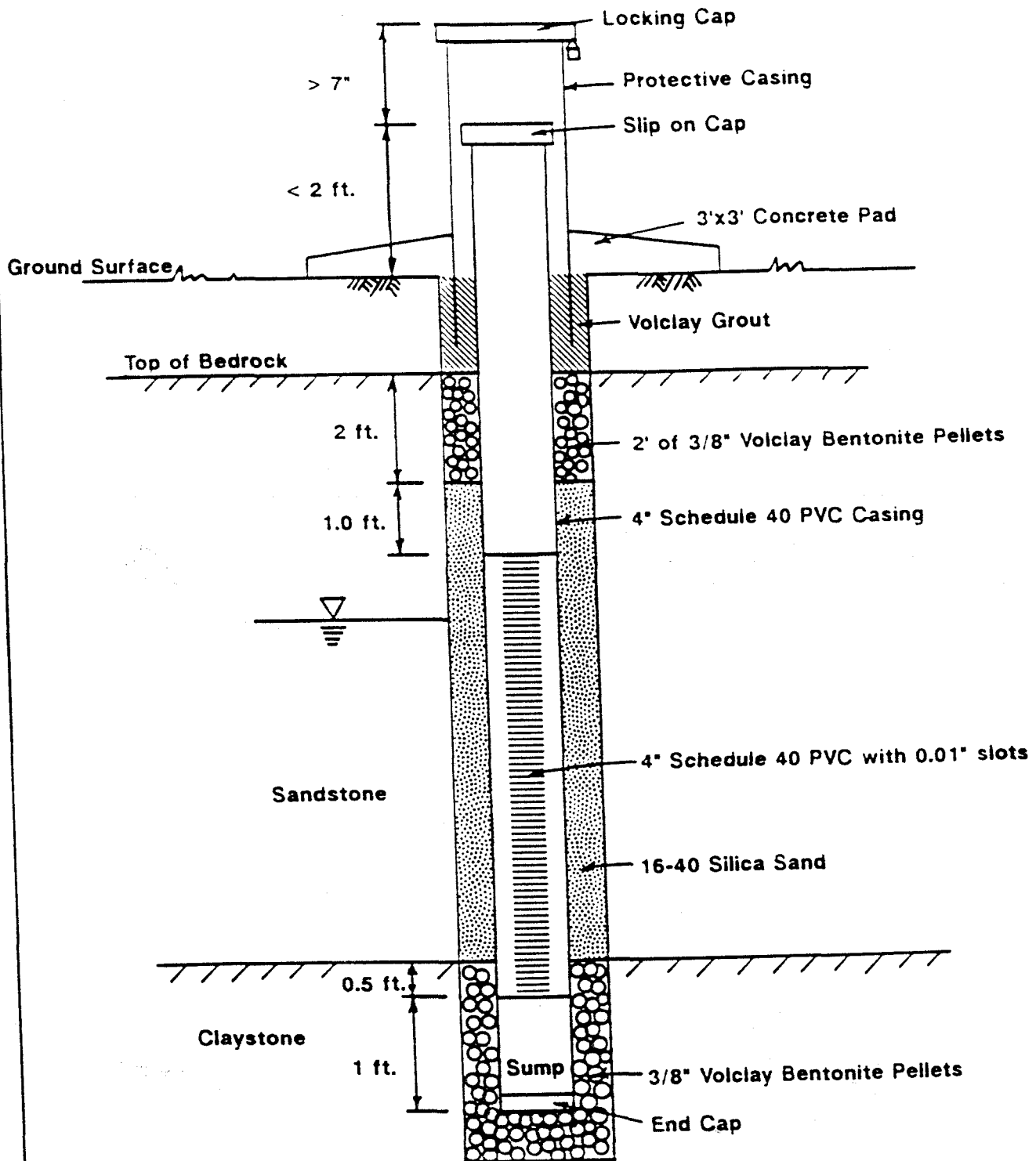
NOT TO SCALE

TYPICAL ALLUVIAL MONITOR WELL CONSTRUCTION



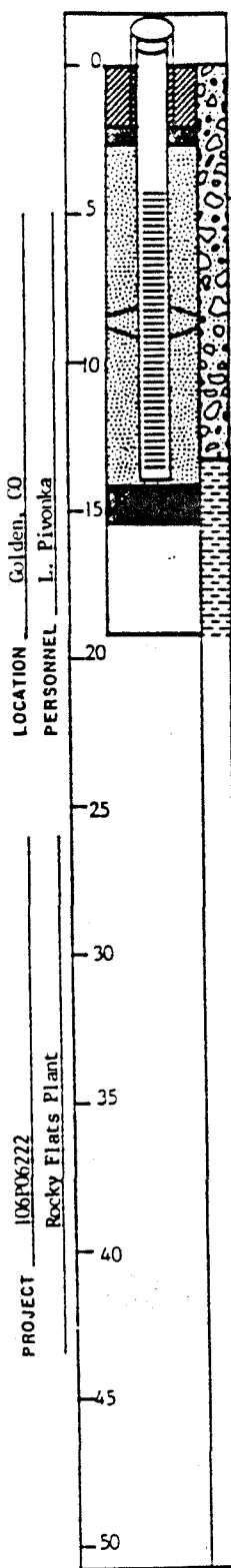


**TYPICAL SHALLOW BEDROCK WELL CONSTRUCTION**  
(weathered claystone)



NOT TO SCALE

**TYPICAL SHALLOW BEDROCK WELL CONSTRUCTION**  
(weathered sandstone)



WELL 17-86

## WELL CONSTRUCTION SUMMARY

LOCATION or COORDS: \_\_\_\_\_ ELEVATION: GROUND LEVEL 5865.26'  
N 38752.3 E 22141.7 TOP OF CASING 5866.55'

### DRILLING SUMMARY:

TOTAL DEPTH Well: 13.98' Hole: 19.20'  
BOREHOLE DIAMETER 7 1/2"  
DRILLER Boyles Brothers Drilling Co.  
15865 W. 5th Avenue  
Golden, CO (Jim Horn)  
RIG Mobile B-57  
BIT(S) Bull nose bit  
DRILLING FLUID None  
SURFACE CASING 5" x 5' steel w/ locking cap

### CONSTRUCTION TIME LOG:

TASK	START		FINISH	
	DATE	TIME	DATE	TIME
DRILLING:	1986		1986	
7 1/2" auger	8/14	0931	8/18	1020
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
2" stainless	8/15	1037	8/15	1040
FILTER PLACEMENT:	8/15	1040	8/15	1056
CEMENTING:	8/15	1100	8/15	1110
DEVELOPMENT:	9/2	1550	9/22	0920
OTHER:				
Bentonite	8/15	1058	8/15	1100
	8/15	1025	8/15	1040

### WELL DESIGN:

BASIS: GEOLOGIC LOG X GEOPHYSICAL LOG \_\_\_\_\_  
CASING STRING(S): C=CASING S=SCREEN  
0.00' 3.73' C1  
3.73' 13.98' S1  
CASING: C1 2" I.D. Sch. 5 type 316 stainless steel threaded and flush jointed.  
SCREEN: S1 2" I.D. Sch. 5 type 316 stainless steel threaded and flush jointed, 0.010" wire wrapped screen, 0.25' welded bottom cap.  
CENTRALIZERS Type 304 stainless steel  
7.97' - 9.09'  
FILTER MATERIAL 10-20 silica sand  
2.50' - 14.00'  
CEMENT Portland Type I  
0.00' - 2.00'  
OTHER 3/8" bentonite pellets  
2.00' - 2.50'  
14.00' - 15.25'

### WELL DEVELOPMENT

See Well Development Summary Sheet.

### COMMENTS:

Water encountered at 4.8' during drilling.  
Top of stainless steel casing: 1.29'  
Cave from ID to 15.25'

HYDRO-SEARCH RENO-DENVER CONSULTING HYDROLOGISTS-GEOLOGISTS

# WELL COMPLETION INFORMATION

Location Rocky Flats Plant; 881 Hillside Area

Well No. 53-87

Coordinates N 35002.12 E 20799.61

Elevation: Ground Surface 5959.82'

Total Depth: Well 9.30'

Top of Casing 5961.84'

Borehole 14.00'

Formation of Completion Colluvium

Casing Material Sch 5, Type 316 TFI stainless steel

Casing Diameter 2" ID

Screen Material 0.010" wire wrap Type 316 TFI

Surface Casing Diameter 5" ID

Date Installed October 13, 1987

Approved By \_\_\_\_\_

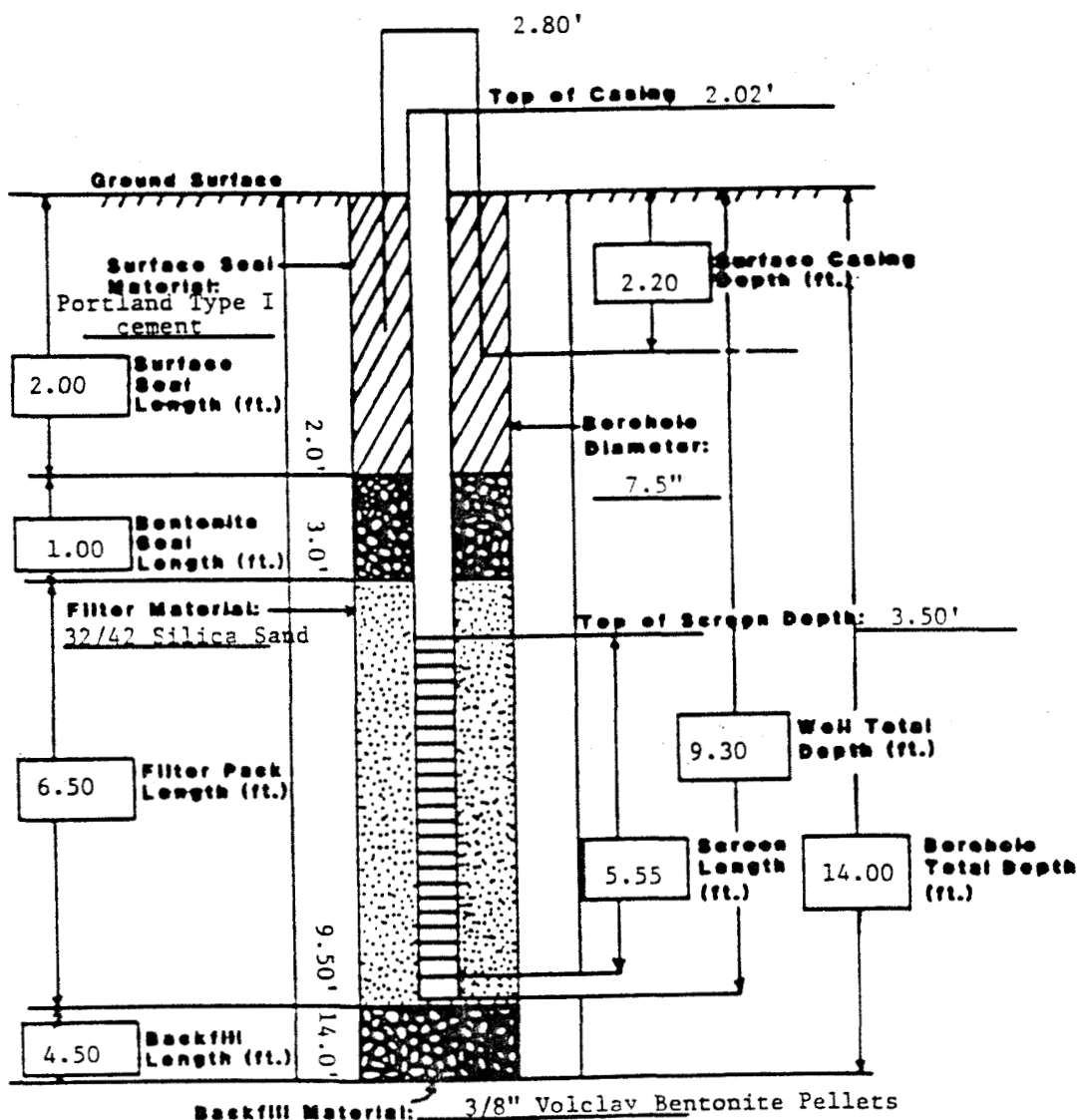
Installed By R.T. Trear

Site Manager

Geologist

Project Director

Comments \_\_\_\_\_



EXAMPLE OF 1987 WELL CONSTRUCTION

# WELL COMPLETION INFORMATION

QA By/Date Julie Burman 14-21-89

Location Rocky Flats Plant: Solar Ponds Area Well No. SEP33-89

Coordinates \_\_\_\_\_ Elevation: Ground Surface \_\_\_\_\_

Total Depth: Well 8.67' Top of Casing \_\_\_\_\_

Borehole 28.1'

Formation of Completion Colluvium

Casing Material Schedule 40 PVC Casing Diameter 4 1/2" O.D.

Screen Material Schedule 40 10-slotted PVC Surface Casing Diameter 8 5/8" O.D.

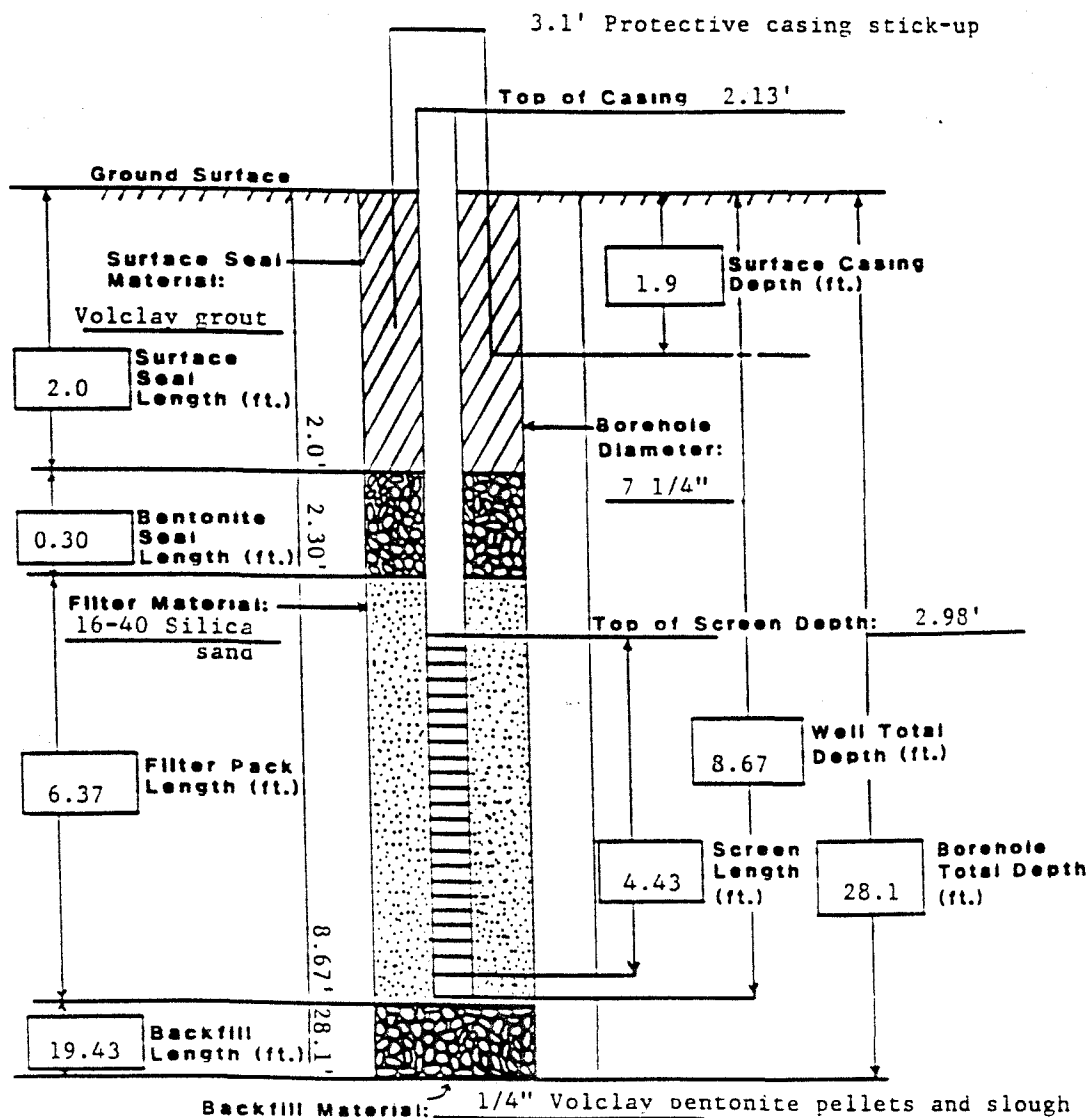
Date Installed 04/20/1989 Approved By Julie Burman

Installed By K.E. Miller Site Manager

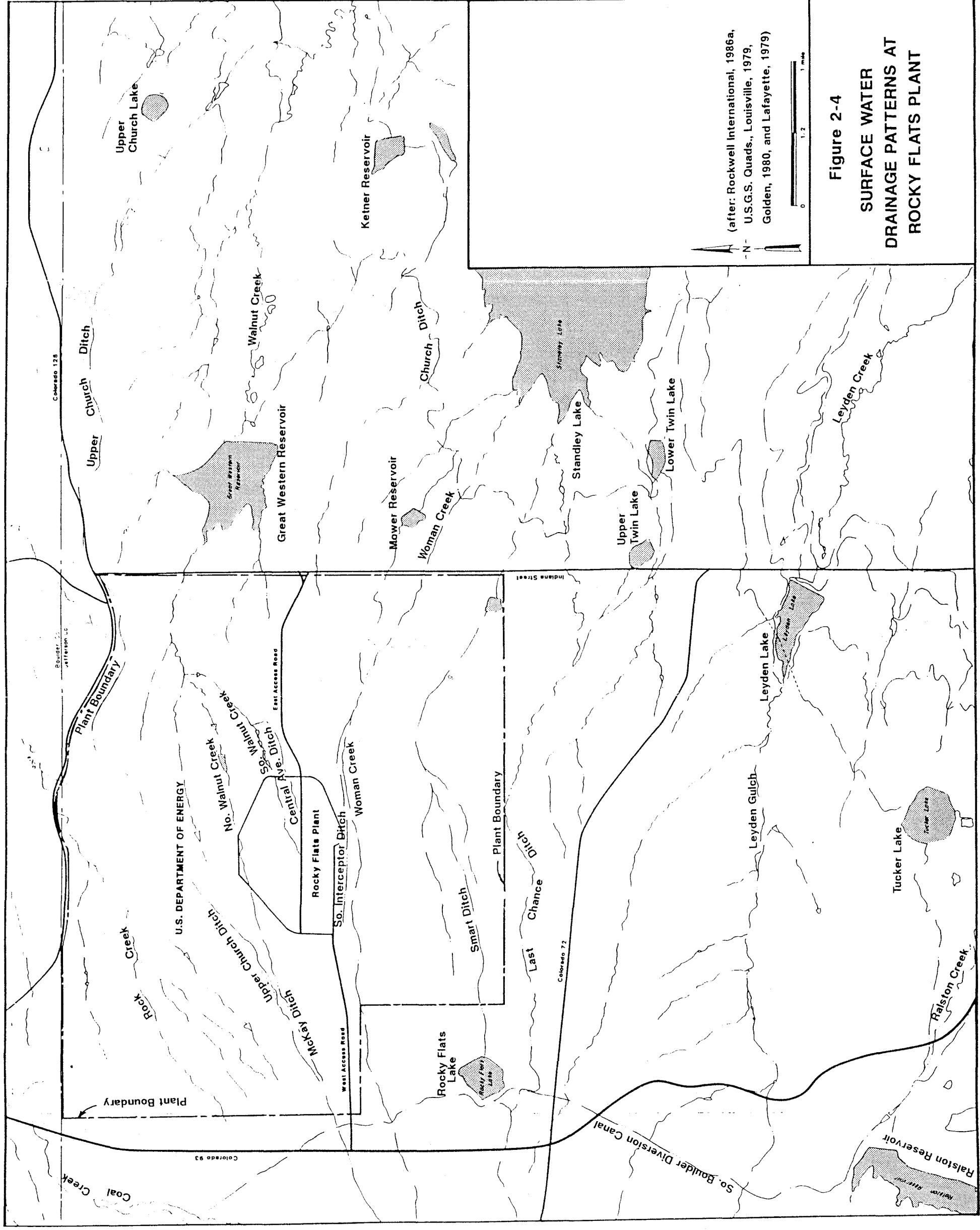
Geologist \_\_\_\_\_

CEARP Manager \_\_\_\_\_

Comments Set stainless steel centralizer from 7.25' to 8.50' below ground surface

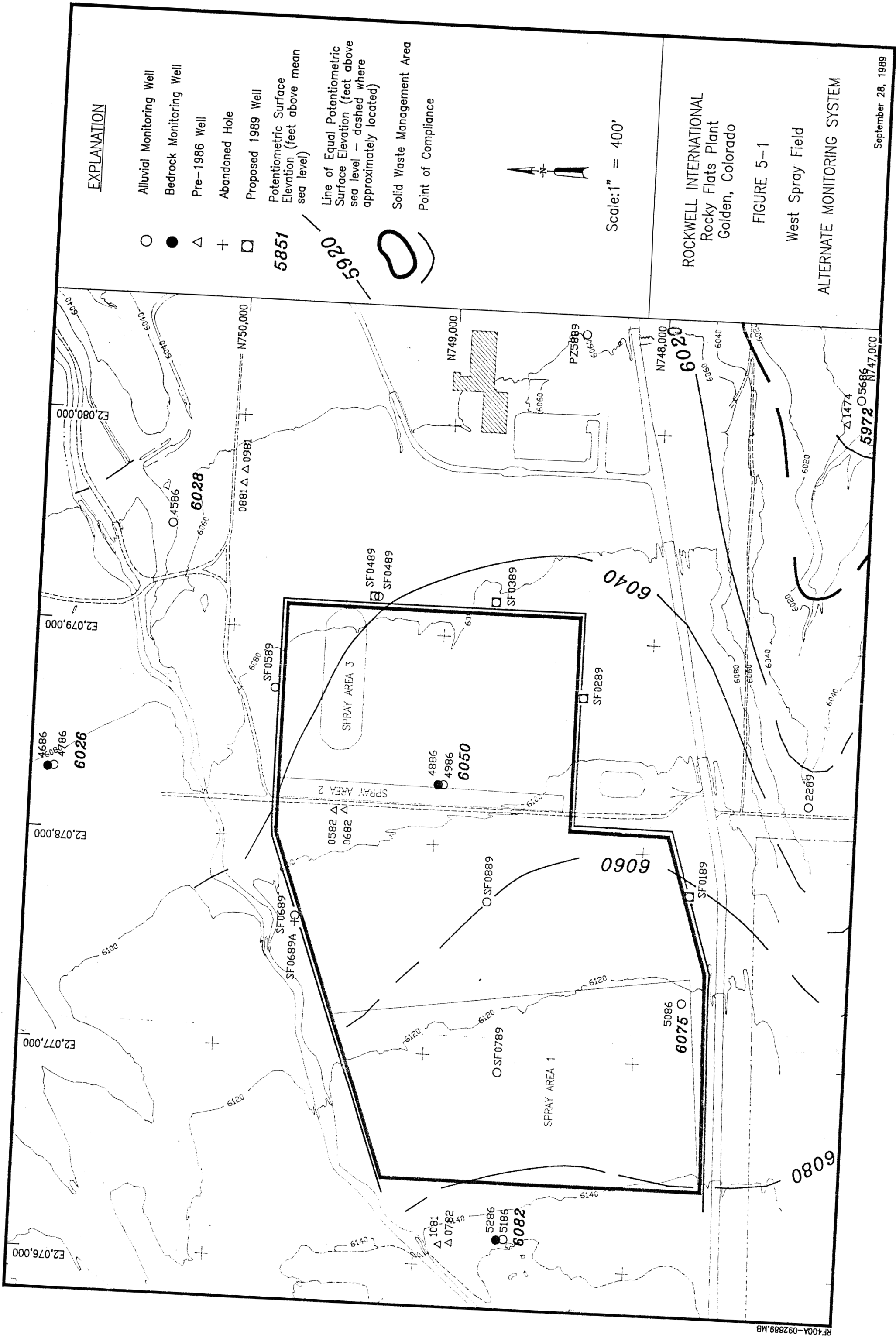


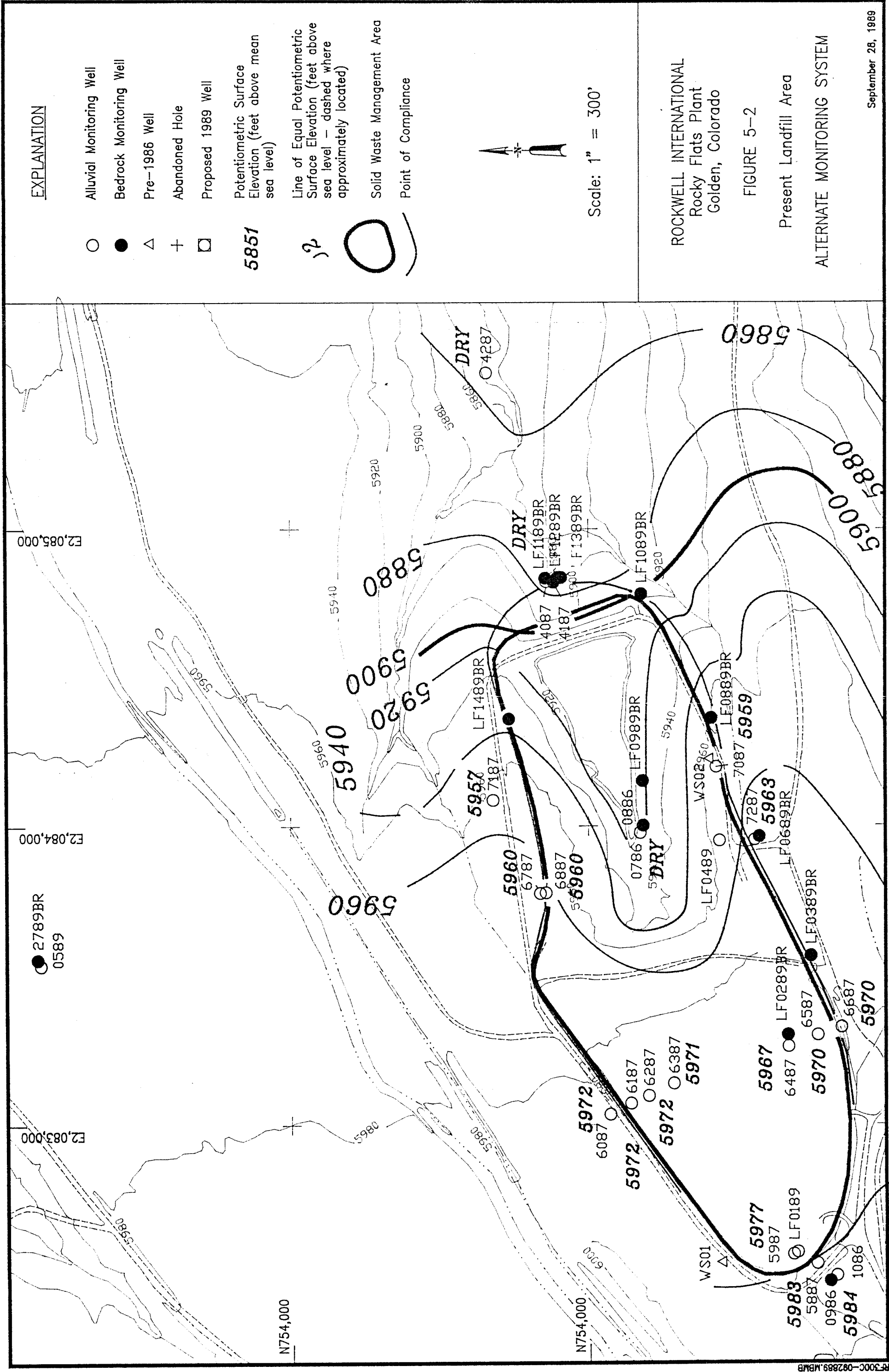
EXAMPLE OF 1989 WELL CONSTRUCTION



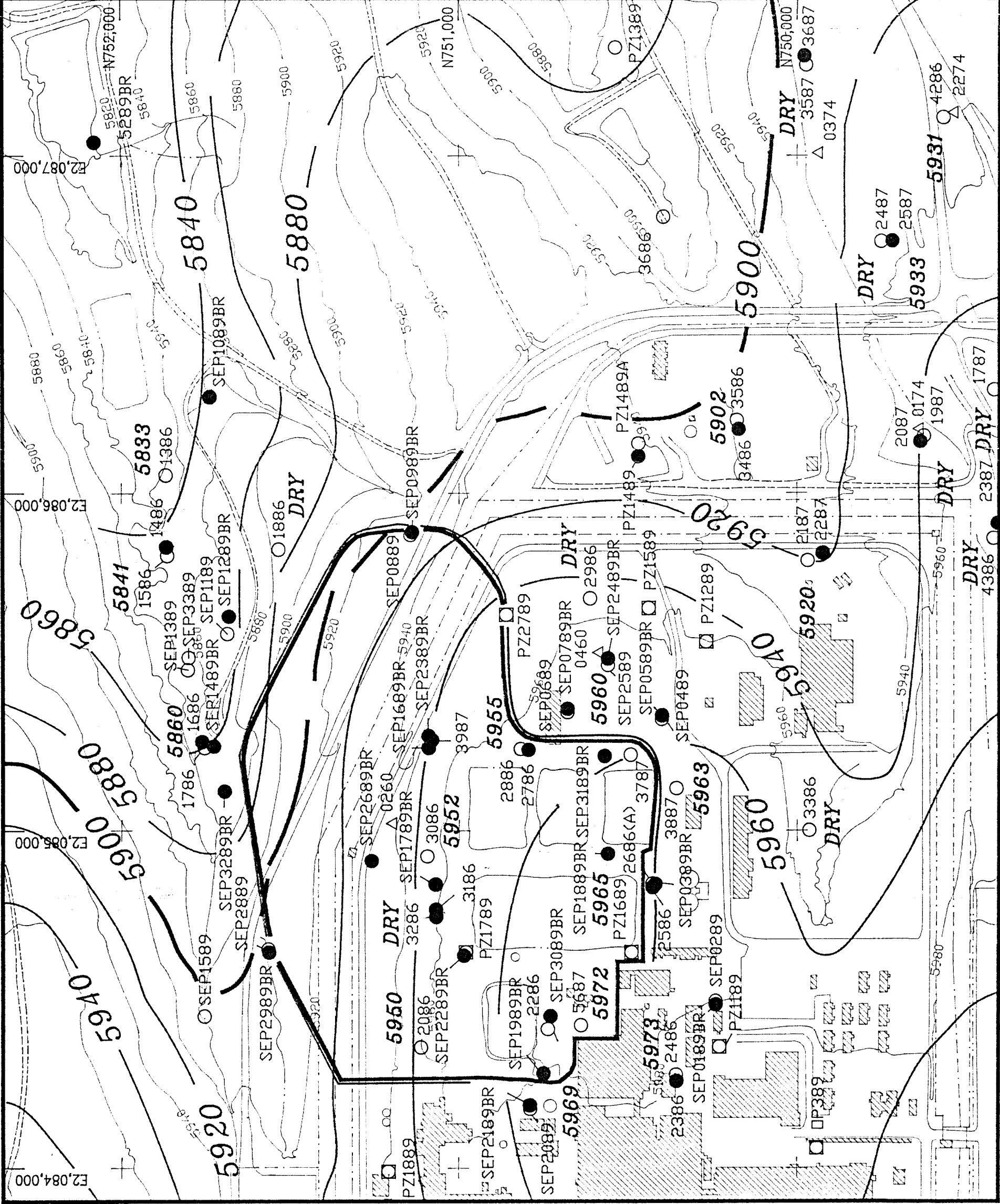
(after: Rockwell International, 1986a,  
U.S.G.S. Quads., Louisville, 1979,  
Golden, 1980, and Lafayette, 1979)

**Figure 2-4**  
**SURFACE WATER**  
**DRAINAGE PATTERNS AT**  
**ROCKY FLATS PLANT**





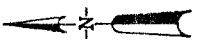




RT3008-092889.MBMR

# EXPLANATION

- Alluvial Monitoring Well
- Bedrock Monitoring Well
- △ Pre-1986 Well
- ⊕ Abandoned Hole
- Proposed 1989 Well
- Potentiometric Surface Elevation (feet above mean sea level)
- Line of Equal Potentiometric Surface Elevation (feet above sea level - dashed where approximately located)
- Solid Waste Management Area
- Point of Compliance



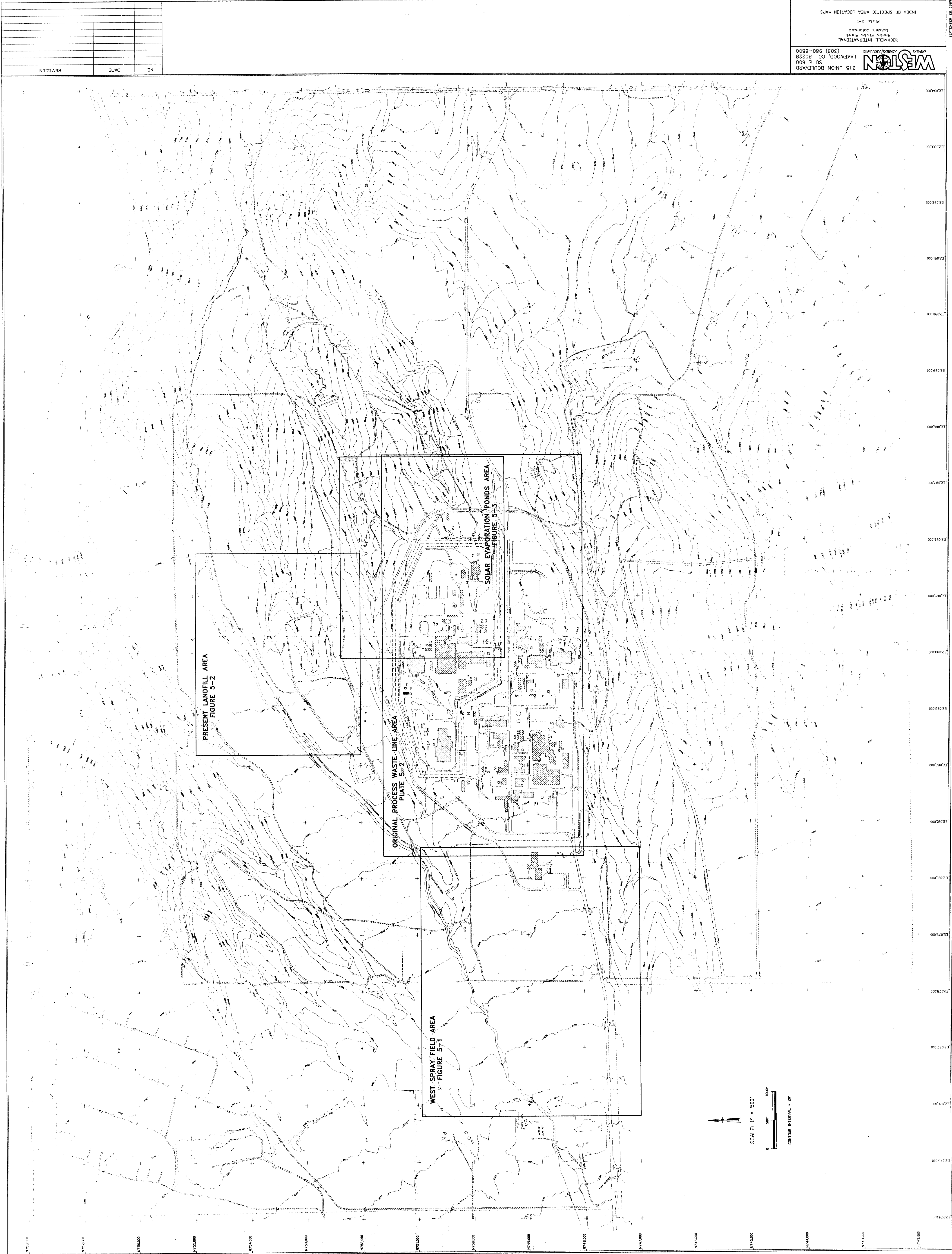
Scale: 1" = 300'

ROCKWELL INTERNATIONAL  
Rocky Flats Plant  
Golden, Colorado

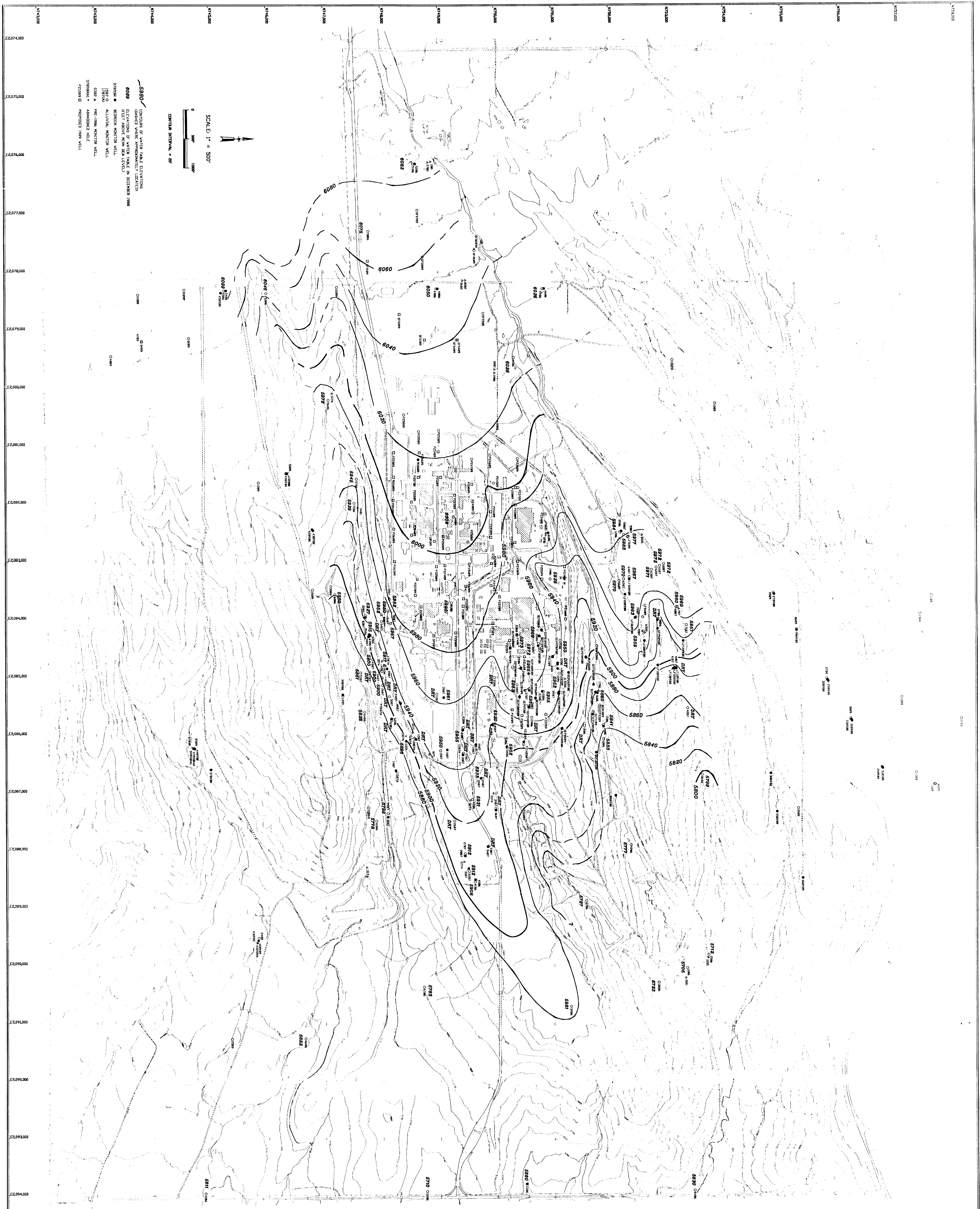
FIGURE 5-3

Solar Evaporation Ponds  
ASSESSMENT MONITORING SYSTEM

September 28, 1989









**5980** CONTOURS OF WATER TABLE ELEVATIONS  
(DASHED WHERE APPROXIMATELY LOCATED)  
**0089** ELEVATIONS OF WATER TABLE IN DECEMBER 1988  
(FEET ABOVE MEAN SEA LEVEL)

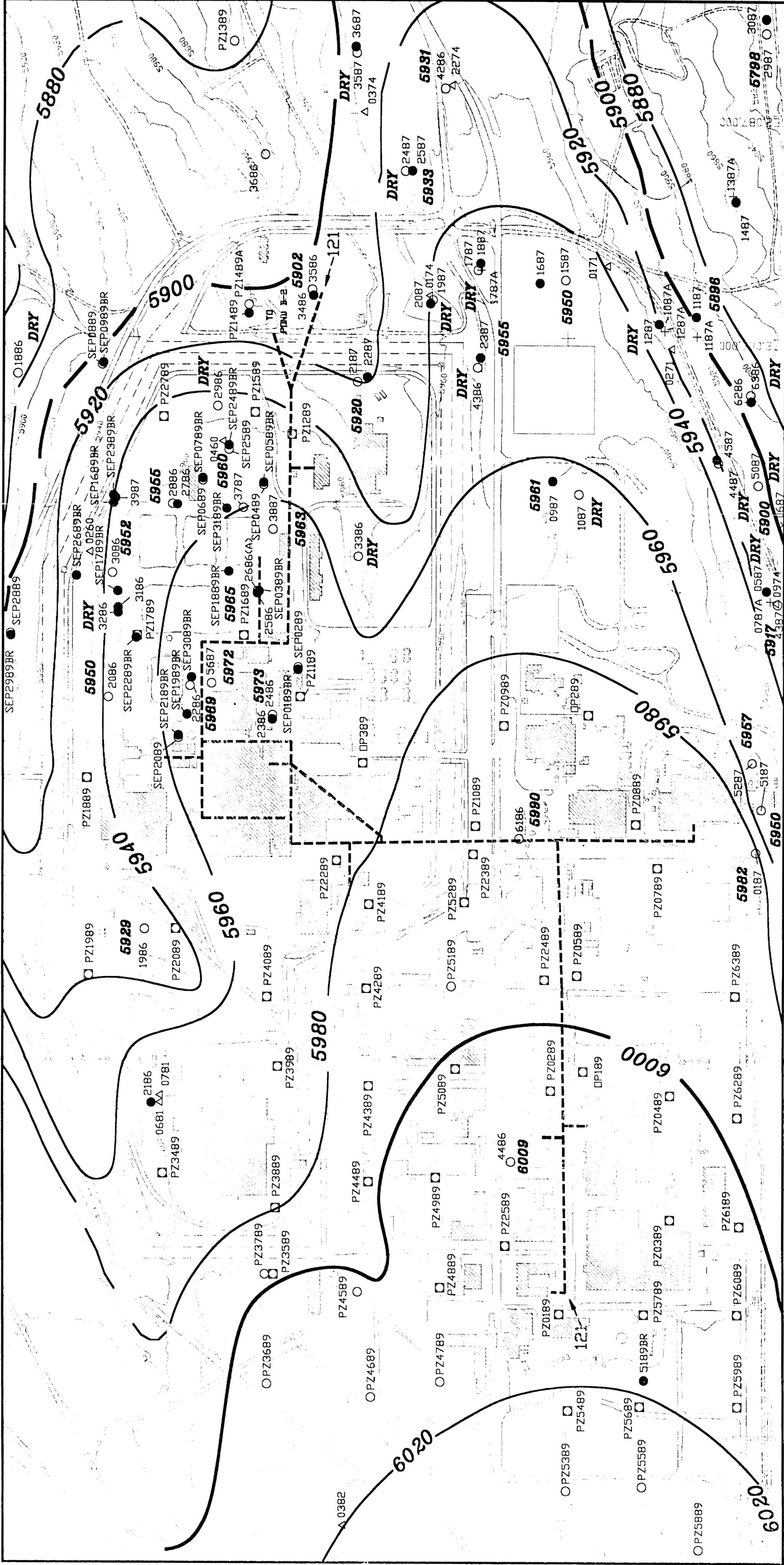
SCALE: 1" = 500'

CONTINUED INTERVAL = 20'



 <p>WESTON MEMBERS DESIGNERS/CONSULTANTS</p>	<p>215 UNION BOULEVARD SUITE 600 LAKEWOOD, CO 80228 (303) 980-6800</p>
	<p>RICKWELL INTERNATIONAL Rocky Flats Plant Golden, Colorado</p> <p>Plate 2-1</p> <p>POTENTIOMETRIC SURFACE OF UNCONFINED FLOW SYSTEM</p>

[illegible]



NO.

DATE

REVISION


5957

POTENTIOMETRIC SURFACE ELEVATION (FEET ABOVE MEAN SEA LEVEL)

5960

LINE OF EQUAL POTENTIOMETRIC SURFACE ELEVATION (FEET ABOVE MEAN SEA LEVEL) - DASHED WHERE APPROXIMATELY LOCATED

5957

ORIGINAL PROCESS WASTE LINE

3789BR

BEDROCK MONITOR WELL

1587

ALLUVIAL MONITOR WELL

0382

PRE-1986 MONITOR WELL

3789BRA1

ABANDONED HOLE

PZ1089

PROPOSED 1989 WELL

▲

▲

○

○

+

□

ORIGINAL PROCESS WASTE LINE

BEDROCK MONITOR WELL

ALLUVIAL MONITOR WELL

PRE-1986 MONITOR WELL

ABANDONED HOLE

PROPOSED 1989 WELL

5957

POTENTIOMETRIC SURFACE ELEVATION (FEET ABOVE MEAN SEA LEVEL)

5960

LINE OF EQUAL POTENTIOMETRIC SURFACE ELEVATION (FEET ABOVE MEAN SEA LEVEL) - DASHED WHERE APPROXIMATELY LOCATED

0

300'

600'

SCALE 1" = 300'

CONTOUR INTERVAL = 20'

WESTON

MANAGERS

DESIGNERS/CONSULTANTS

215 UNION BOULEVARD  
LAKEWOOD, CO 80228  
(303) 980-6800

ROCKWELL INTERNATIONAL  
Rocky Flats Plant  
Golden, Colorado

Plate 5-2

ORIGINAL PROCESS WASTE LINE AREA  
LOCATION OF MONITORING WELLS

RF 300D-083089.MB SEPTEMBER 1, 1989